PROJECT MANUAL – NW ENTRY CONSTRUCTION DOCUMENTS

Cumberland County Civic Center Renovation

Cumberland County Recreation Center D/B/A

Portland, Maine

Architect Project No. 3757.00

WBRC ARCHITECTS·ENGINEERS

30 DANFORTH STREET

SUITE 306

PORTLAND, MAINE 04101

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Issued: October 31, 2012

DIVISION 21 - FIRE SUPPRESSION

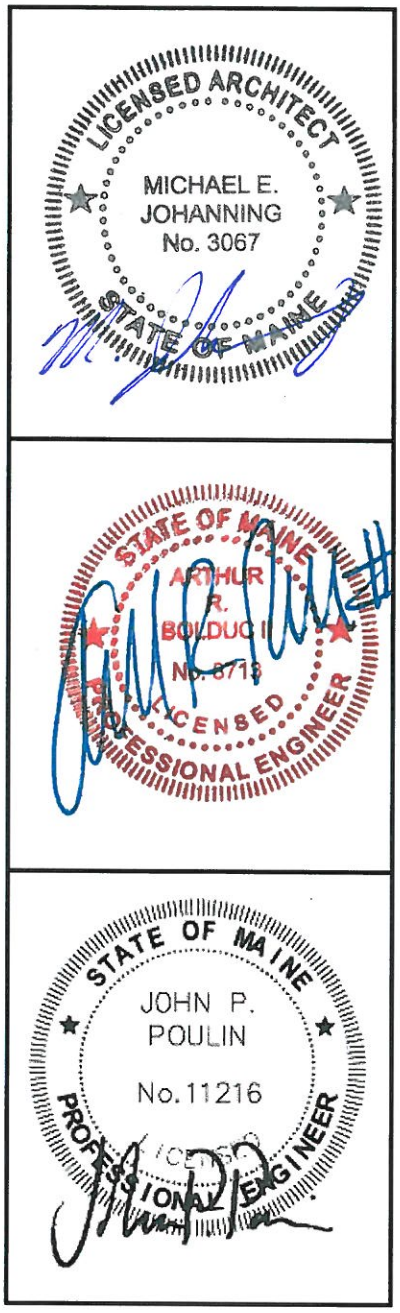
DIVISION 22 - PLUMBING

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

DOCUMENT 000107 - SEALS PAGE

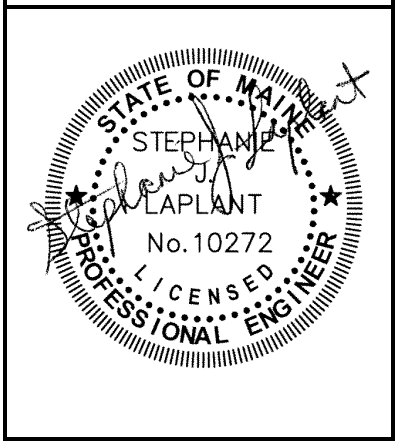
1.1 DESIGN PROFESSIONALS OF RECORD

ARCHITECT	Michael E Johanning, AIA License No.: 3067
CIVIL ENGINEER	A. Ray Bolduc, P.E. License No.: 8713
STRUCTURAL ENGINEER	John P. Poulin, P.E. License No.: 11216



ELECTRICAL ENGINEER	Daniel C. Monroe, P.E. License No.: 9977

ELECTRICAL ENGINEER	Stephanie J. Laplant, P.E. License No.: 10272



END OF DOCUMENT 000107

DOCUMENT 000115 - LIST OF DRAWING SHEETS (NW ENTRY CONSTRUCTION DOCUJMENTS)

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Cumberland County Civic Center Renovation, dated October 31, 2012, as modified by subsequent Addenda and Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

VOLUME 1

GENERAL
G0.01 COVER SHEET VOLUME 1
G0.02 DRAWING LIST VOLUME 1
G0.03 SYMBOLS AND ABBREVIATIONS
LSA.00 MECHANICAL LEVEL - LIFE SAFTEY PLAN
LSA.10 EVENT LEVEL - LIFE SAFETY PLAN
LSA.20 CONCOURSE LEVEL - LIFE SAFETY PLAN
LSA.30 MID SUITES LEVEL - LIFE SAFETY PLAN
LSA.40 UPPER SUITE LEVEL - LIFE SAFETY PLAN

CIVIL
GI006 SITE GENERAL NOTES & ABBREVIATIONS
1 OF 1 TOPOGRAPHY SURVEY
GR901 CENTER STREET SITE PHOTOS
GR902 FREE STREET SITE PHOTOS
GR903 SPRING STREET SITE PHOTOS
GR904 ELEVATED SITE PHOTOS
PH100 SITE PHASING PLAN - PHASE I
PH101 SITE PHASING PLAN - PHASE II
CD101 SITE REMOVALS PLAN
CD102 SITE LEDGE REMOVALS PLAN
CP101 SITE LAYOUT AND MATERIALS PLAN
CG101 SITE GRADING AND EROSION CONTROL PLAN
CU101 SITE UTILITY PLAN
CU301 SITE LARGE SCALE UTILITY PLAN
CU302 SITE UTILITY PLAN & PROFILE
CU303 SITE UTILITY PLAN & PROFILE
LP101 SITE PLANTING PLAN
C501 SITE DETAILS
C502 SITE DETAILS
C503 SITE DETAILS
C504 SITE DETAILS
C505 SITE DETAILS
C506 SITE DETAILS
C601 SITE BORING LOGS
C602 SITE BORING LOGS

STRUCTURAL

S0.01 STRUCTURAL GENERAL NOTES
S0.02 STRUCTURAL TESTS AND SPECIAL INSPECTIONS
S2.21A MAIN CONCOURSE LEVEL FOUNDATION PLAN - QUAD A
S2.31A MID SUITE LEVEL FLOOR FRAMING PLAN - QUAD A
S2.41A UPPER SUITE LEVEL FLOOR FRAMING PLAN - QUAD A
S2.61A ROOF FRAMING PLAN
S2.71A ENLARGED FRAMING PLANS
S3.00 TYPICAL CONCRETE FOUNDATION SECTIONS AND DETAILS
S3.01 TYPICAL CONCRETE FOUNDATION SECTIONS AND DETAILS
S3.02 CONCRETE FOUNDATION SECTIONS AND DETAILS
S3.03 CONCRETE FOUNDATION SECTIONS AND DETAILS
S5.00 TYPICAL STEEL FRAMING SECTIONS AND DETAILS
S5.01 STEEL FLOOR FRAMING SECTIONS AND DETAILS
S5.02 STEEL FLOOR FRAMING SECTIONS AND DETAILS
S5.05 STEEL ROOF FRAMING SECTIONS AND DETAILS

ARCHITECTURAL

AD2.21A CONCOURSE LEVEL REMOVALS PLAN QUAD A
AD2.31A MID SUITES LEVEL REMOVALS PLAN QUAD A
AD2.41A UPPER SUITES LEVEL REMOVALS PLAN QUAD A
AD3.01 EXTERIOR REMOVAL ELEVATIONS AND DETAILS
A2.21A CONCOURSE LEVEL FLOOR PLAN - PHASE 1
A2.31A MID SUITES LEVEL FLOOR PLAN - PHASE 1
A2.41A UPPER SUITES LEVEL FLOOR PLAN - PHASE 1
A2.61A ROOF LEVEL PHASE 1
A3.01 BUILDING ELEVATIONS PHASE 1
A3.20 BUILDING SECTIONS
A3.21 BUILDING SECTIONS
A3.22 BUILDING SECTIONS
A3.23 BUILDING SECTIONS
A3.24 BUILDING SECTIONS
A3.40 WALL SECTIONS
A3.41 WALL SECTIONS
A3.42 WALL SECTIONS
A4.21 ENLARGED PLANS - CONCOURSE LEVEL
A4.31 ENLARGED PLANS
A4.41 ENLARGED PLANS
A5.00 TOILET DETAILS AND ACCESSORIES
A5.21 INTERIOR ELEVATIONS
A5.31 INTERIOR ELEVATIONS
A5.50 STANDARD MILLWORK DETAILS
A6.21A CONCOURSE LEVEL REFLECTED CEILING PLAN - PHASE 1
A6.31A MID SUITES LEVEL REFLECTED CEILING PLAN - PHASE 1
A6.41A UPPER SUITES LEVEL REFLECTED CEILING PLAN - PHASE 1
A7.10 STAIR PLANS & SECTIONS
A7.11 ELEVATOR PLANS & SECTIONS
A8.10 FOUNDATION DETAILS
A8.20 PLAN DETAILS
A8.30 SECTION DETAILS
A8.40 ROOF DETAILS
A9.00 WALL TYPE TYPICAL
A9.01 PARTITION FRAMING CRITERIA
A9.10 TYPICAL CEILING DETAILS

A9.70 ROOM FINISH SCHEDULE
A9.80 DOOR & FRAME SCHEDULE - PHASE 1
A9.85 DOOR DETAILS
A9.90 WINDOW SCHEDULE - EXTERIOR GLAZING

VOLUME 2

FIRE PROTECTION
FD2.20A MAIN CONCOURSE FIRE PROTECTION REMOVALS PLAN - PHASE 1
FP2.20A MAIN CONCOURSE FIRE PROTECTION PLAN - PHASE 1
FP2.30A MID SUITES FIRE PROTECTION PLAN - PHASE 1
FP2.40A UPPER SUITES FIRE PROTECTION PLAN - PHASE 1

PLUMBING
PD2.11A EVENT LEVEL PLUMBING REMOVALS PLAN - QUAD A - PHASE 1
PD2.21A CONCOURSE LEVEL PLUMBING REMOVALS PLAN - QUAD A - PHASE 1
P2.11A EVENT LEVEL PLUMBING PLAN - QUAD A - PHASE 1
P2.21A CONCOURSE LEVEL PLUMBING PLAN - QUAD A - PHASE 1
P2.31A MID SUITES LEVEL PLUMBING PLAN - QUAD A - PHASE 1
P2.41A UPPER SUITES LEVEL PLUMBING PLAN - QUAD A - PHASE 1
P5.01 PLUMBING DETAILS
P6.01 PLUMBING SCHEDULES
PFS1.0 ENLARGED CONCESSIONS PLUMBING PLANS

MECHANICAL
M0.01 MECHANICAL LEGEND
MD2.03A MECHANICAL LEVEL MECHANICAL REMOVALS PLAN
M2.21A CONCOURE LEVEL MECHANICAL PLAN - QUAD A PHASE 1
M2.31A MIDSUITES LEVEL MECHANICAL LEVEL - QUAD A PHASE 1
M2.41A UPPER SUITES LEVEL MECHANICAL PLAN - QUAD A PHASE 1
M5.03 MECHANICAL DETAILS
M6.01 MECHANICAL SCHEDULES
M6.02 MECHANICAL SCHEDULES
M8.01 MECHANICAL SMOKE CONTROL SCHEMATICS

ELECTRICAL
E0.01 ELECTRICAL LEGEND, ABBREVIATIONS AND LIGHT FIXTURE SCHEDULE
ED.21A CONCOURSE LEVEL DEMO PLAN - QUAD A
E1.21A CONCOURSE LEVEL LIGHTING PLAN - QUAD A
E1.31A MID SUITES LEVEL LIGHTING PLAN - QUAD A
E1.41A UPPER SUITES LEVEL LIGHTING PLAN - QUAD A
E2.21A CONCOURSE LEVEL POWER PLAN - QUAD A
E2.31A MID SUITES LEVEL POWER PLAN - QUAD A
E2.41A UPPER SUITES LEVEL POWER PLAN - QUAD A
E3.21A CONCOURSE LEVEL SYSTEMS PLAN - QUAD A
E3.31A MID SUITES LEVEL SYSTEMS PLAN - QUAD A
E3.41A UPPER SUITES LEVEL SYSTEMS PLAN - QUAD A
E4.01A ENLARGED ELECTRICAL PLANS
E5.01 ELECTRICAL DETAILS
E5.02 ELECTRICAL DETAILS
E5.03 ELECTRICAL DETAILS
E6.01A PANELBOARD SCHEDULES

END OF DOCUMENT 000115

DOCUMENT 000115 - LIST OF DRAWING SHEETS (NW ENTRY ~~REMOVALS~~ FSE)

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Cumberland County Civic Center Renovation, dated ~~July 27, 2012~~ August 23, 2012, as modified by subsequent Addenda and Contract modifications.

B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:

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G0.01 COVER SHEET
G0.02 DRAWING LIST
G0.03 SYMBOLS AND ABBREVIATIONS
LS.01 MECHANICAL LEVEL - LIFE SAFTEY PLAN
LS.10 EVENT LEVEL - LIFE SAFETY PLAN
LS.20 CONCOURSE LEVEL - LIFE SAFETY PLAN
LS.30 MID SUITES LEVEL - LIFE SAFETY PLAN
LS.40 UPPER SUITE LEVEL - LIFE SAFETY PLAN

CIVIL
GI006 SITE GENERAL NOTES & ABBREVIATIONS
1 OF 1 TOPOGRAPHY SURVEY
GR901 CENTER STREET SITE PHOTOS
GR902 FREE STREET SITE PHOTOS
GR903 SPRING STREET SITE PHOTOS
GR904 ELEVATED SITE PHOTOS
PH100 SITE PHASING PLAN - PHASE I – **ADDENDUM 2.4**
PH101 SITE PHASING PLAN - PHASE II
CD101 SITE REMOVALS PLAN
CD102 SITE LEDGE REMOVALS PLAN
CP101 SITE LAYOUT AND MATERIALS PLAN – **ADDENDUM 2.1**
CG101 SITE GRADING AND EROSION CONTROL PLAN – **ADDENDUM 2.2**
CU101 SITE UTILITY PLAN – **ADDENDUM 2.3**
CU301 SITE LARGE SCALE UTILITY PLAN
CU302 SITE UTILITY PLAN & PROFILE
CU303 SITE UTILITY PLAN & PROFILE
LP101 SITE PLANTING PLAN
C501 SITE DETAILS
C502 SITE DETAILS
C503 SITE DETAILS
C504 SITE DETAILS
C505 SITE DETAILS
C506 SITE DETAILS
C601 SITE BORING LOGS
C602 SITE BORING LOGS

STRUCTURAL
S0.01 STRUCTURAL GENERAL NOTES
S0.02 STRUCTURAL TESTS AND SPECIAL INSPECTIONS
S2.21A MAIN CONCOURSE LEVEL FOUNDATION PLAN - QUAD A – **ADDENDUM 2.5**
S2.31A MID SUITE LEVEL FLOOR FRAMING PLAN - QUAD A
S2.41A UPPER SUITE LEVEL FLOOR FRAMING PLAN - QUAD A – **ADDENDUM 2.6**
S2.51A CATWALK LEVEL PLAN - QUAD A
S2.61A ROOF FRAMING PLAN – **ADDENDUM 2.7**
S2.71A ENLARGED FRAMING PLANS – **ADDENDUM 2.8**
S3.00 TYPICAL CONCRETE FOUNDATION SECTIONS AND DETAILS
S3.01 TYPICAL CONCRETE FOUNDATION SECTIONS AND DETAILS
S3.02 CONCRETE FOUNDATION SECTIONS AND DETAILS
S3.03 CONCRETE FOUNDATION SECTIONS AND DETAILS – **ADDENDUM 2.9**
S5.00 TYPICAL STEEL FRAMING SECTIONS AND DETAILS – **ADDENDUM 2.10**
S5.01 STEEL FLOOR FRAMING SECTION AND DETAILS – **ADDENDUM 2.11**
S5.02 STEEL FLOOR FRAMING SECTIONS AND DETAILS – **ADDENDUM 2.12**
S5.05 STEEL ROOF FRAMING SECTIONS AND DETAILS – **ADDENDUM 2.13**

ARCHITECTURAL
AD2.21A CONCOURSE LEVEL REMOVALS PLAN QUAD A
AD2.31A MID SUITES LEVEL REMOVALS PLAN QUAD A – **ADDENDUM 2.14**
AD2.41A UPPER SUITES LEVEL REMOVALS PLAN QUAD A – **ADDENDUM 2.15**
AD3.01 EXTERIOR REMOVAL ELEVATIONS AND DETAILS – **ADDENDUM 2.16**
A2.21A CONCOURSE LEVEL FLOOR PLAN - PHASE 1
A2.31A MID SUITES LEVEL FLOOR PLAN - PHASE 1
A2.41A UPPER SUITES LEVEL FLOOR PLAN - PHASE 1
A2.61A ROOF LEVEL PHASE 1
A3.01 BUILDING ELEVATIONS PHASE 1
A3.20 BUILDING SECTIONS
A3.21 BUILDING SECTIONS
A3.22 BUILDING SECTIONS
A3.23 BUILDING SECTIONS
A3.24 BUILDING SECTIONS
A3.40 WALL SECTIONS
A3.41 WALL SECTIONS
A3.42 WALL SECTIONS
A4.01 ENLARGED PLANS
A4.21 ENLARGED PLANS – **ADDENDUM 3.4**
A5.00 TOILET DETAILS AND ACCESSORIES
A5.50 STANDARD MILLWORK DETAILS
A5.51 STANDARD MILLWORK DETAILS
A6.21A CONCOUSE LEVEL REFLECTED CEILING PLAN - PHASE 1
A6.31A MID SUITES LEVEL REFLECTED CEILING PLAN - PHASE 1
A6.41A UPPER SUITES LEVEL REFLECTED CEILING PLAN - PHASE 1
A7.10 STAIR PLANS & SECTIONS
A7.11 ELEVATOR PLANS & SECTIONS
A7.20 STAIR / GUARDRAIL DETAILS
A7.22 GUARDRAIL DETAILS - ARENA
A7.40 BOWL HANDRAIL/GUARDRAIL DETAILS
A8.10 FOUNDATION DETAILS – **ADDENDUM 2.17**
A8.20 PLAN DETAILS – **ADDENDUM 2.18**
A8.30 SECTION DETAILS – **ADDENDUM 2.19**
A8.40 ROOF DETAILS – **ADDENDUM 2.20**

A9.00 WALL TYPE TYPICAL
A9.01 PARTITION FRAMING CRITERIA
A9.02 TYPICAL CEILING DETAILS
A9.85 DOOR DETAILS
A9.90 WINDOW SCHEDULE - EXTERIOR GLAZING
A9.91 WINDOW SCHEDULE - INTERIOR GLAZING
A9.95 WINDOW FRAME DETAILS - AL
A9.96 WINDOW FRAME DETAILS – HM

PLUMBING
PD2.11A EVENT LEVEL PLUMBING REMOVALS PLAN - QUAD A
PD2.21A CONCOURSE LEVEL PLUMBING REMOVALS PLAN - QUAD A
P2.11A EVENT LEVEL PLUMBING PLAN - QUAD A
P2.21A CONCOURSE LEVEL PLUMBING PLAN - QUAD A
P2.31A MID SUITES LEVEL PLUMBING PLAN
P2.41A UPPER SUITES LEVEL PLUMBING PLAN
P6.01 PLUMBING SCHEDULES

MECHANICAL
M2.31A MIDSUITES LEVEL MECHANICAL LEVEL - QUAD A PHASE 1
M0.01 MECHANICAL LEGEND
MD2.03A MECHANICAL LEVEL MECHANICAL DEMO PLAN
M2.21A CONCOURE LEVEL MECHANICAL PLAN - QUAD A PHASE 1
M2.41A UPPER SUITES LEVEL MECHANICAL PLAN - QUAD A PHASE 1
M5.01 MECHANICAL DETAILS
M6.01 MECHANICAL SCHEDULES
M8.01 MECHANICAL SMOKE CONTROL SCHEMATICS

ELECTRICAL
E0.01A ELECTRICAL LEGEND, ABBREVIATIONS AND LIGHIT FIXTURE SCHEDULE
ED.03 MECHANICAL LEVEL ELECTRICAL DEMO PLAN
ED.21A CONCOURSE LEVEL DEMO PLAN - QUAD A
E1.21A CONCOURSE LEVEL LIGHTING PLAN - QUAD A
E1.31A MID SUITE LEVEL LIGHTING PLAN - QUAD A
E1.41A UPPER SUITE LEVEL LIGHTING PLAN - QUAD A
E2.21A CONCOURSE LEVEL POWER PLAN - QUAD A
E2.31A MID SUITE LEVEL POWER PLAN - QUAD A
E2.41A UPPER SUITE LEVEL POWER PLAN - QUAD A
E3.21A CONCOURSE LEVEL SYSTEMS PLAN - QUAD A
E3.31A MID SUITE LEVEL SYSTEMS PLAN - QUAD A
E3.41A UPPER SUITE LEVEL SYSTEMS PLAN - QUAD A
E5.02A ELECTRICAL DETAILS

END OF DOCUMENT 000115

DOCUMENT 000115 - LIST OF DRAWING SHEETS (NW ENTRY REMOVALS AND SITE CONSTRUCTION DOCS)

1.1 LIST OF DRAWINGS

A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing set titled Cumberland County Civic Center Renovation, dated July 27, 2012, as modified by subsequent Addenda and Contract modifications.

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LS.20 CONCOURSE LEVEL - LIFE SAFETY PLAN
LS.30 MID SUITES LEVEL - LIFE SAFETY PLAN
LS.40 UPPER SUITE LEVEL - LIFE SAFETY PLAN

CIVIL
GI006 SITE GENERAL NOTES & ABBREVIATIONS
1 OF 1 TOPOGRAPHY SURVEY
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PH100 SITE PHASING PLAN - PHASE I – **ADDENDUM 2.4**
PH101 SITE PHASING PLAN - PHASE II
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CD102 SITE LEDGE REMOVALS PLAN
CP101 SITE LAYOUT AND MATERIALS PLAN – **ADDENDUM 1.4, 2.1**
CG101 SITE GRADING AND EROSION CONTROL PLAN – **ADDENDUM 2.2**
CU101 SITE UTILITY PLAN – **ADDENDUM 1.5, 2.3**
CU301 SITE LARGE SCALE UTILITY PLAN – **ADDENDUM 1.6**
CU302 SITE UTILITY PLAN & PROFILE
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C503 SITE DETAILS
C504 SITE DETAILS – **ADDENDUM 1.9**
C505 SITE DETAILS
506 SITE DETAILS – **ADDENDUM 1.10**
C601 SITE BORING LOGS
C602 SITE BORING LOGS

ARCHITECTURAL
AD2.21A CONCOURSE LEVEL REMOVALS PLAN QUAD A
AD2.31A MID SUITES LEVEL REMOVALS PLAN QUAD A – **ADDENDUM 2.14**

AD2.41A UPPER SUITES LEVEL REMOVALS PLAN QUAD A – **ADDENDUM 2.15**
AD3.01 EXTERIOR REMOVAL ELEVATIONS AND DETAILS – **ADDENDUM 2.16**
AD2.00B MECHANICAL LEVEL REMOVALS PLAN - PHASE 2
AD2.10B EVENT LEVEL REMOVALS PLAN - PHASE 2
AD2.20B CONCOURSE LEVEL REMOVALS PLAN - PHASE 2
AD2.30B MID SUITES LEVEL REMOVALS PLAN - PHASE 2
AD2.40B UPPER SUITES LEVEL REMOVALS PLAN - PHASE 2
AD2.50B CATWALK REMOVALS PLAN - PHASE 2

PLUMBING
PD2.11A EVENT LEVEL PLUMBING REMOVALS PLAN - QUAD A

MECHANICAL
MD2.03A MECHANICAL LEVEL MECHANICAL DEMO PLAN

ELECTRICAL
E0.01A ELECTRICAL LEGEND, ABBREVIATIONS AND LIGHIT FIXTURE SCHEDULE
ED.03A MECHANICAL LEVEL ELECTRICAL DEMO PLAN
ED.21A CONCOURSE LEVEL DEMO PLAN - QUAD A

END OF DOCUMENT 000115

DOCUMENT 003000 - INFORMATION AVAILABLE TO CONTRACTOR

The following information is provided for informational purposes only. It is not part of the Contract document.

1. A Geotechnical Report was prepared by S.W. Cole Engineering, Inc., for the Owner on this project. A copy is included in the Appendix of this project manual. Boring logs are also included with the drawing sheets.
2. A Hazardous Materials Identification Report was prepared by Summit Environmental Consultants, Inc., for the Owner on this project. A copy is included in the Appendix of this project manual.
3. A Building Code Report was prepared by FP&C Consultants, Inc., for this project. A copy is included in the Appendix of this project manual.

END OF DOCUMENT 003000

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Work phases.
4. Work under other contracts.
5. Products ordered in advance.
6. Owner-furnished products.
7. Use of premises.
8. Owner's occupancy requirements.
9. Work restrictions.
10. Specification formats and conventions.

B. Related Sections include the following:

1. Division 1 Section "Summary of Multiple Contracts" for division of responsibilities for the Work.
2. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Cumberland County Civic Center Renovation

1. Project Location: One Civic Center Square, Portland, ME 04101

B. Owner: Cumberland County Recreation Center d/b/a

1. Owner's Representative: To Be Determined

C. Architect: WBRC Architects · Engineers, 30 Danforth Street, Suite 306, Portland, ME 04101

D. Construction Manager: Cianbro.: One Hunnewell Square Pittsfield, ME 04967

1. Construction Manager for this Project is Project's Constructor. In Divisions 1 through 33 Sections, the terms "Construction Manager" and "Contractor" are synonymous.

E. The Work consists of the following:

1. The work includes phased construction 37,800 +/- SF of additions and 118,400 +/- SF of renovations to the existing Cumberland County Civic Center building to expand its ability to accommodate a range of spectator, assembly, and exhibition events. This includes new accessible entrances, suites, loading and staging area, foodservice, seating, and office space. Work includes but is not limited to, earthwork, site utilities and site improvements, paving, and landscaping. Work also includes demolition and shoring, concrete foundations and slab-on-grade, steel structure, steel joists and decking, roof membrane system over roof insulation, sheet metal, masonry, precast concrete architectural elements, metal stud partitions, insulation, gypsum board walls and ceilings, ceramic tile, acoustical ceilings, resilient flooring, acoustic wall treatment, carpeting, custom cabinets and fixtures, carpentry, glass storefront and curtain wall systems, painting, metal doors, wood doors, metal frames, door hardware, overhead coiling doors and grilles, metal fabrications, toilet partitions and accessories, telescoping seating, elevators, escalators, audio visual equipment, signage, fire protection and detection systems, fireproofing, electrical, including replacement and upgrade of electrical service and generator, heating, ventilating, and air conditioning complete and ready for use.

1.4 TYPE OF CONTRACT

A. Project will be constructed under a single prime contract.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.

1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
11. Contractor shall install and otherwise incorporate Owner-furnished / Contractor Installed (OS/CI) items into the Work.

B. Owner-Furnished Products:

1. The following are OS/OI equipment items:

a. Toilet Room Accessories

2. The following are OS/CI equipment items: N/A

1.6 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy of Project site.
2. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.7 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner will occupy existing building during the phase one construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than (5) five working days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

B. The start date of construction for the project will be August 27, 2012.

C. The project is expected to be completed and ready for occupancy by September 20, 2013.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 49-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted..

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

C. The contract documents are complementary, and what is called for by any one shall be as binding as if called for by all. The intention of the documents is that, unless otherwise specified, the Contractor shall furnish all labor, materials, equipment, items, articles, tools, transportation, insurance, services, necessary supplies, operations or methods and incidentals that may be reasonably required to construct and complete the project, facility or improvement in a manner necessary for the proper execution of the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Quantity allowances.

C. Related Sections include the following:

1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.
2. Division 01 Section "Unit Prices" for procedures for using unit prices.
3. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
4. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM UNIT-COST AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Return unused Lump Sum amounts for credit to Owner.

1.7 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.

2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

B. All allowances will be carried by the General Contractor.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include $5,000 to provide ADA compliant interior signage at the NW entry offices.

B. Allowance No. 2: Include $500,000 for Electrical Utilities Allowance.

C. Allowance No. 3: Include $75,000 to provide Cutting & Patching Allowance not indicated in the Contract Documents.

D. Allowance No. 4: Include lump-sum allowance of $50,000 for “excess” rock excavation and disposal offsite (trench and open) not indicated on the Contract Documents. Coordinate quantity allowance adjustment with corresponding unit-price requirements in Section 012200 "Unit Prices."

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Division 01 Section "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 1 – Rock Excavation and Removal and replacement with approved materials to subgrade (open):

1. Description: Rock excavation, including removal from site.
2. Unit of Measurement: Cu. yard of excavated material.

B. Unit Price No. 2 – Rock Excavation and Removal and replacement with approved materials to subgrade (trench):

1. Description: Rock excavation, including removal from site.
2. Unit of Measurement: Cu. yard of excavated material.

C. Unit Price No. 3 – Gravel Base:

1. Description: Gravel base, in place.
2. Unit of Measurement: Cu. yard of gravel material.

D. Unit Price No. 4 – Gravel Subbase:

1. Description – Gravel Subbase, in place.
2. Unit of Measurment Cu.yard of gravel material

E. Unit Price No. 5 – Bituminous Pavement – HMA 9.5 mm:

1. Description: Bituminous pavement – HMA 9.5 mm, compacted in place.
2. Unit of Measurement: Per ton.

F. Unit Price No. 6 – Bituminous Pavement – HMA 19.0 mm:

1. Description: Bituminous pavement – HMA 19.0 mm, compacted in place.
1. Unit of Measurement: Per ton.

G. Unit Price No. 7 – Brick sidewalk

1. Description: Brick Sidewalk, in place.
2. Unit of Measurement: Per square yard

H. Unit Price No. 8 – Concrete sidewalk/pad

1. Description: Concrete Sidewalk/Pad, in place.
2. Unit of Measurement: Per square yard

I. Unit Price No. 9 – ADA Ramp

1. Description: ADA Ramp, in place.

2. Unit of Measurement: Each

J. Unit Price No. 10 – Street Tree (Serviceberry)

1. Description: Street Tree, in place.
2. Unit of Measurement: Each

K. Unit Price No. 11 – Street Tree (Red Maple)

1. Description: Street Tree, in place.
2. Unit of Measurement: Each

L. Unit Price No. 12 – Decorative Bollard

1. Description: Decorative Bollard, in place.
2. Unit of Measurement: Each

M. Unit Price No. 13 – Foundation drain

1. Description: 6" perforated drain, in place
2. Unit of Measurement: Per linear foot

N. Unit Price No. 14 – Hot mix asphalt pavement milling/grinding

1. Description: Hot mix asphalt pavement milling/grinding, including removal from site
2. Unit of Measurement: Per square yard

O. Unit Price No. 15 – Provide and Place Flowable Fill:
1. Description: Provide and place flowable fill.
2. Unit of Measurement: Cu. yard of flowable fill material.

P. Unit Price No. 16 – Cast-in-place Concrete Foundations:
1. Description: 3,500 psi Cast-in Place Concrete, including forming, reinforcing, placing, curing and stripping formwork for footings, foundation walls and piers
2. Unit of Measurement: Per Cu. Yard

Q. Unit Price No. 17 – Cast-in-place Concrete Flatwork:
1. Description: 3,500 psi Cast-in Place Concrete, including reinforcing, placing and curing for either slabs-on grade or slabs-on-metal deck
2. Unit of Measurement: Per Cu. Yard

END OF SECTION 012200

SECTION 012300 – ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate Bid Item No. 1: Remove Finish Materials (to include all final finish materials - floor finishes, wall finishes, ceiling finishes, counters, lockers, paint, millwork and trim, toilet partitions and specialties) from the following rooms:

Room Name:	Room No.:
Home Team Lockers	1400
Sticks	1400A
Street Change	1400B
RR	1400C
Steam	1400D
Showers	1400E
Lounge	1400F
Fitness	1400G
Hydro	1400H
Sports Med	1400J
Trainer	1400K
Asst. Coach	1400L
RR	1400M
Head Coach	1400N
Laundry / Equip / Skate Shop	1401

B. Alternate Bid item No. 2: Install telescopic risers at the east end of the seating bowl without integrated folding seating. All other required railings and equipment will be provided and installed.

C. Alternate Bid item No. 3: Remove stained floor finish from existing concrete concourse. Repair cracks in excess of 1/32" in width, grind areas of uneven surface to provide a smooth finish.

D. Alternate Bid item No. 4: Replace bullet-resistant glass at ticket counter windows with tempered glass of equal thickness.

E. Alternate Bid item No. 5: Connect the Fire Pump to the Backup Generator. Provide a design for this connection to the Electrical engineer for review and approval prior to connection.

F. Alternate Bid item No. 6: Replace Hydraulic dock levelers with manual dock levelers.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution will not adversely affect Contractor's construction schedule.
c. Requested substitution has received necessary approvals of authorities having jurisdiction.
d. Requested substitution is compatible with other portions of the Work.
e. Requested substitution has been coordinated with other portions of the Work.
f. Requested substitution provides specified warranty.

g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions, Special Conditions, and other DIVISION 01 Specification Sections, apply to Work of this section.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:

      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Contractor's Construction Schedule.

   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.

   1. Identification: Include the following Project identification on the Schedule of Values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value.

1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Progress payments shall be submitted to Architect by the 10th day of the month. The period covered by each Application for Payment is one month, ending on the last day of the previous month.

C. Payment Application Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Section 006276 – AIA G702 – 1992 Contractor's Application and Certification for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner. Refer to Section 006519.160-01 – AIA G706A – 1994 Contractor's Affidavit of Release of Liens for sample form

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's Construction Schedule (preliminary if not final).
4. Products list.
5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Contractor's staff assignments.
8. List of Contractor's principal consultants.

9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. Evidence that claims have been settled.
7. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Project meetings.
   2. Administrative and supervisory personnel
   3. Requests for Interpretation (RFIs) – NW ENTRY REMOVALS & SITE ADDENDUM 1.1

B. Related Sections include the following:
   1. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
   1. Division 1 Section "Closeout Procedures" for coordinating Contract closeout. Division 1 Section "General Commissioning Requirements" for general requirements that apply to implementation of commissioning.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Startup and adjustment of systems.
7. Project closeout activities.

1.4 SUBMITTALS

~~A. Certificate statement of manufacturer's compliance with ARRA "Buy American" (The American Recovery and Reinvestment Act of 2009). Refer to Section 007301.~~ **– NW ENTRY REMOVALS & SITE ADDENDUM 1.1**

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

2. Submit Construction Waste Management and Construction IAQ Management Plans.

1.5 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for requests for interpretations (RFIs).
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Preparation of Record Documents.
    l. Use of the premises and existing building.
    m. Work restrictions.
    n. Owner's occupancy requirements.
    o. Responsibility for temporary facilities and controls.
    p. Construction waste management and recycling.
    q. Parking availability.
    r. Office, work, and storage areas.
    s. Equipment deliveries and priorities.
    t. First aid.
    u. Security.
    v. Progress cleaning.
    w. Working hours.
    x. Funding source requirements.
    y. Construction Waste Management
    z. Construction IAQ

3. Minutes: Contractor will record and distribute meeting minutes to Architect, Owner and all invited attendees.

C. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Hazards and risks.
7) Status of correction of deficient items.
8) Field observations.
9) Requests for interpretations (RFIs).
10) Status of proposal requests.
11) Pending changes.
12) Status of Change Orders.
13) Pending claims and disputes.
14) Documentation of information for payment requests.

3. Minutes: Contractor will record and distribute meeting minutes to Architect, Owner and all invited attendees.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

D. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction. – NW ENTRY REMOVALS & SITE ADDENDUM 1.1

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. The Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.

q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Contractor will record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Contractor will distribute minutes of the meeting to each party present and to parties who should have been present.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

1.6 REQUESTS FOR INTERPRETATION (RFIs) – NW ENTRY REMOVALS & SITE ADDENDUM 1.1

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.

1. Submit electronic RFI with attachments as PDF electronic files directly to the NEWFORMA Info Exchange site specifically established for the Project. Submit data/drawings/etc for only one (1) topic per RFI. A brief tutorial handout will be provided at the preconstruction meeting.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow 10 working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for coordination information already indicated in the Contract Documents.
   d. Requests for adjustments in the Contract Time or the Contract Sum.
   e. Requests for interpretation of Architect's actions on submittals.
   f. Incomplete RFIs or RFIs with numerous errors.

2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
   2. Submittals Schedule.
   3. Daily construction reports.
   4. Field condition reports.
   5. Special reports.

B. Related Sections include the following:
   1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

H. Major Area: A story of construction, a separate building, or a similar significant construction element.

I. Milestone: A key or critical point in time for reference or measurement.

J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

A. Qualification Data: For scheduling consultant.

B. Submittals Schedule: Submit **~~three~~ electronic** copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

C. Contractor's Construction Schedule: Submit three opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

D. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

E. Daily Construction Reports: Submit **~~three~~ electronic** copies at monthly intervals.

F. Field Condition Reports: Submit **~~three~~ electronic** copies at time of discovery of differing conditions.

G. Special Reports: Submit three copies at time of unusual event.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.

2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, d except for 60 +/- days for heating, mechanical rough-in, electrical rough-in and beam / column fabrication / testing.

a.

2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
3. Startup and Testing Time: Include not less than 10 working days for startup and testing.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Use of premises restrictions.
    e. Provisions for future construction.
    f. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Fabrication.
    e. Deliveries.
    f. Installation.
    g. Tests and inspections.
    h. Adjusting.
    i. Curing.
    j. Startup and placement into final use and operation.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion , and the following interim milestones:

1. Completion of Foundations

2. Completion of weathertight shell

3. Completion of concrete slabs and curing

4. time for system start-up and testing

5. Time for system training

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 10 days of date established for the Notice to Proceed. Base

schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require 1 month or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 10 days of date established for the Notice to Proceed. Outline significant construction activities for the first 30 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 20 days after date established for the Notice to Proceed.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Mobilization and demobilization.
c. Purchase of materials.
d. Delivery.
e. Fabrication.
f. Utility interruptions.
g. Installation.
h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.

16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as “informational submittals.”

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action or Informational
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in 'Autodesk Revit Architecture 2012'.
    c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 business days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is required, allow 20 business days for initial review of each submittal.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements for Projects Processed as Electronic Submittals: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals as PDF electronic files directly to the NEWFORMA Info Exchange site specifically established for the Project. A brief tutorial handout will be provided at the preconstruction meeting.

    a. Submit data/drawings/etc for only one (1) Specification Section per submittal.
    b. Do not combine action and informational items in the same submittal.
    c. Informational submittals shall be clearly marked with “INFO-” at the beginning of the subject line. Architect will not return informational submittals that are in compliance.
    d. Each submittal shall be a single PDF file with portrait and/or landscape orientation applied correctly, that includes the following:
        1) A GC Transmittal Letter with details of the submittal item, including Specification Section number, type and description of what is being submitted – for example: 061753 Drawings - Wood Trusses.
        2) A Separate cover sheet with the GC review stamp leaving sufficient space for the Architect’s review stamp.
        3) Data, drawings, etc., that relate to the submittal item.

4) Black or red marks (arrows, circles, bubbles) to indicate specific product information as applicable.

e. Electronic submittals are acceptable for all documents (i.e. large format drawings and samples), unless noted otherwise.

1) If hard copies of large format drawings are required, refer to individual Specification Sections for details and Paragraph 2.1.A.2.

2) Samples: Hard copies are required for all samples, refer to Paragraph 2.1.A.2.e. For electronic copy instructions, refer to Paragraph 2.1.E .

~~2. Submit HARD COPY submittals on an as needed basis as follows:~~

~~a. Submit data/drawings/etc. for only one (1) Specification Section per transmittal.~~
~~b. Submit the same GC Transmittal Letter with details of the submittal item, including the Specification Section number, type and description of what is being submitted as was sent in the electronic copy.~~
~~c. Submit the same cover sheet with the GC review stamp as was sent in the electronic copy.~~
~~d. Submit a hard copy of the same data, drawings, etc., that relate to the submittal item as was sent in the electronic copy, but in the full size intended.~~
~~e. Submit actual samples with an ID label that has appropriate information attached (Project Number, Specification Section number, GC's submittal number, etc.). Refer to Paragraph 2.1.E.~~

3. Submittals received after 2 PM will be processed and logged as being received on the next business day.

4. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

B. General Submittal Procedure Requirements for Projects Processed as Hard Copies: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit HARD COPY submittals as follows:

a. Submit data/drawings/etc. for only one (1) Specification Section per transmittal.
b. Include the GC Transmittal Letter with details of the submittal item(s), including the Specification Section number, type and description.
c. Include a cover sheet with the GC review stamp leaving sufficient space for the Architect's review stamp.
d. Include 3 hard copies of the data, drawings, etc., that relate to the submittal item in the full size intended.
e. Submit actual samples with an ID label that has appropriate information attached (Project Number, Specification Section number, GC's submittal number, etc.).
1) remit one (1) physical sample or color chart with transmittal letter to the Architect's office, unless noted otherwise in individual Specification Sections. Identification: Attach label on unexposed side of Samples that includes the following:
a) Name of Project
b) Generic description of Sample
c) Product name and name of manufacturer
d) Sample source
e) Number and title of applicable Specification Section

f) Specification paragraph number and generic name of each item

2. Submittals received after 2 PM will be processed and logged as being received on the next business day.

3. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file

C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file unless otherwise noted.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale (i.e. PDF's shall not be reduced from the scale at which they were drawn). Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

    a. PDF electronic file unless drawing size is larger than 11”x17”
        1) For drawings larger than 11”x17” inches, determine with the Project Manager whether or not there are specific arrangements for in house printing of large size drawings; otherwise remit one (1) hard copy to the Architect.
        2) Refer to individual Specification Sections for additional requirements and provide as necessary.

E. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Submit a PDF electronic file in color if applicable of samples that contain multiple, related components such as accessories together in one submittal package.
    a. Also remit one (1) physical sample or color chart with transmittal letter and cover sheet to the Architect’s office, unless noted otherwise in individual Specification Sections. Identification: Attach label on unexposed side of Samples that includes the following:
        1) Name of Project
        2) Generic description of Sample.
        3) Product name and name of manufacturer.
        4) Sample source.
        5) Number and title of applicable Specification Section.
        6) Specification paragraph number and generic name of each item.
2. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

F. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.

G. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

H. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation.”

I. Contractor's Submittal Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures", "Operation and Maintenance Data", and "Project Record Documents."

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

L. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

M. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

N. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

O. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

P. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

Q. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

R. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

S. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

T. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

U. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

V. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

W. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

X. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Y. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Z. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file certificate signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures", “Operation and Maintenance Data”, and “Project Record Documents.”

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. Reviewed, No Exceptions Taken: Final Unrestricted Release. Work may proceed, provided it complies with the Contract Documents.
2. Reviewed, Revise as Noted: Final But Conditional Release. Work may proceed, provided it complies with the notations and corrections on submittals and with Contract Documents. Architect's comments shall be considered a part of the original submittal. Should Contractor disagree with any such comments, so notify the Architect within fourteen (14) days after receipt of such transmittal and before commencing work on the items in question. Failing this, Contractor shall be deemed to have agreed to such comments by the Architect and to have accepted full responsibility for implementing them at no additional cost to the Owner.
3. Revise and Resubmit: Returned for Resubmittal. Do not proceed with the work at the site or allow submittal at site. Fabrication in shop or factory may proceed on items not affected by the Architect's comments only. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking.
4. Rejected: Where submittal is returned for other reasons, with Architect's explanation included.

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Construction Manager, Owner, or authorities having jurisdiction (AHJ) are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ISO/IEC Standard 17025, and that specializes in types of tests and inspections to be performed.

H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1. Contractor responsibilities include the following:
   a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
   b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
   c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
   d. When testing is complete, remove assemblies; do not reuse materials on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copies to Contractor and Construction Manager. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.6 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by AHJ as the responsibility of Owner.

1. Testing agency will notify Architect, Construction Manager and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor, Construction Manager and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and re-inspect corrected work.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within thirty (30) days of date established for commencement of the Work.

1. Distribution: Distribute schedule to Owner, Construction Manager, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.7 QUALITY ASSURANCE AND QUALITY CONTROL SYSTEM

A. Establish, document and maintain a quality assurance and quality control system capable of verifying to the satisfaction of the Architect that all materials and workmanship, whatever their sources, conform to

the requirements of the Specification.

B. The quality program shall be defined in a quality control manual or similar document in which the organization systems, inspection and test plan procedures are fully described to ensure that all essential inspection requirements are determined and satisfied throughout all phases of the works.

C. Construction Manager to establish a tolerance quality control manual to cover all aspects of tolerance compliance relating to the works. A quality control proposal shall be prepared for submission to the Architect for acceptance. This shall describe, in detail, the various types of quality control checks that shall be carried out during each stage of the works; what means and methods shall be used; which personnel shall be employed, together with their qualifications, and how each type of tolerance check shall be recorded and kept for future reference.

D. Construction Manager's proposals for the quality control manual shall meet the requirements of this section as a minimum and be submitted to the Architect. Provide facilities in the event that the Architect wishes to examine these proposals at the Works. Include details of formal approvals held for the Construction Manager's or sub-contractor's quality system or any evaluations or assessments carried out by independent third parties.

E. Within 30 days of the written order to proceed, submit a comprehensive quality control manual to the Architect for review, amendment where appropriate, and acceptance.

F. Include with the quality control manual an inspection and test plan for each major item of work or type of fabrication which shall detail, in sequential order:

1. The principal activities to be carried out.
2. The type, method and frequency of inspections and tests to be carried out.
3. The inspecting authority.
4. The acceptance criteria.
5. The records to be kept.

G. The inspection and test plan shall contain sufficient space for the Architect to indicate on it the activities he wishes to inspect as either "hold" or "witness" points.

1. A "hold" point is defined as a point on the inspection and test plan beyond which the process may not continue until it has been accepted by the Architect.
2. A "witness" point is defined as a point on the inspection and test plan where the Contractor shall give reasonable notice that a particular part of the process has been reached although the process may continue without acceptance being notified by the Architect.

H. The inspection and test plan shall provide the basis of inspection for the item of work and shall be accepted prior to commencement of the work.

I. At all times during the Contract period, make available at the works all necessary resources and facilities and implement any reviews and amendments of the quality control manual deemed necessary or desirable by the Architect.

J. As a minimum the quality control manual shall include information and procedures as defined below:

1. Organization and Management.
2. Facilities, Measuring and Test Equipment.
3. Personnel Training and Certification.
4. Documentation.
5. Receipts, Storage, Handling and Transportation.

6. Materials.
7. Welding.
8. Fabrication and Erection.
9. Tolerance Control.
10. Prototypes.
11. Painting and Coating.
12. Inspection and Testing of Materials and Workmanship.
13. Non-conforming Items.
14. Design.
15. Control of Purchased Materials and Services.
16. Completed Item, Inspection and Test Results.
17. Records.
18. Review of the Quality System.

K. Means of Auditing

1. The Architect shall review the Contractor's proposals and carry out such tasks as are necessary to ensure that:

    a. The Contractor's methods of working are likely to produce acceptable work.
    b. Finished items and assemblies conform to the Specification.

2. Nominate a senior member of the technical organization as Quality Manager who shall be independent of the other functions and be held responsible for all matters relating to the production and implementation of the quality control manual.
3. At any stage during the Contract period, including those times prior to fabrication, make all facilities available to the Architect such that quality audits, according to an established system, may be carried out.
4. Keep and maintain, at an agreed location, a copy of all relevant check certificates for inspection by the Architect upon request.
5. If the Architect detects any deficiencies, either in the work or the Construction Manager's QA/QC system, these matters shall be reported. Each item affected by said deficiencies shall be considered as being of suspect quality and shall be physically quarantined in a separate holding area. No work may be carried out on these items until the Architect instructs to either rework or repair the affected item, or declares it shall be outside the Specification and therefore rejected.

L. Quality Control Methods

1. The appointment of any sub-contractors, or the carrying out of any work at any place other than the Contractor's nominated principal workplace, shall only occur with the acceptance of the Architect and Construction Manager. The work shall be carried out only under equivalent conditions of QA/QC to those at the nominated principal workplace. Demonstrate to the satisfaction of the Architect the methods by which he selects, controls, inspects and verifies that the work carried out by the sub-contractor conforms to the requirements of the Specification.
2. Make available to the Architect copies of each purchase order for any item or service wished to be included within the works. Each purchase order shall fully detail the item or service in terms of quality, grade, type, appropriate Standard applicable, inspection, test and documentation requirements.
3. The organization and management of the Construction Manager's QA/QC program shall be confirmed to be comprehensive and effective for the provision of work to the Specification requirements. All such details shall be fully described in a document, referred to as the quality control manual, which shall be accepted for use by the Architect.
4. All facilities, measuring and test equipment shall be re-calibrated and checked against standards

at whatever frequency is determined appropriate by the equipment manufacturer. Where such items are not considered by the Architect and Construction Manager to give sufficiently accurate readings or results, or are not able to produce consistent results, they shall not be used on this Contract.

5. Personnel training and certification shall be subject to the acceptance of the Construction Manager.
6. Documentation of materials and processes shall only be considered adequate when, having been checked by the Architect, they are deemed by the Architect to verify that the Specification requirements are, in all respects, satisfied.
7. Receipt and storage of incoming materials shall be suitably controlled such that, in the opinion of the Construction Manager, it can be readily confirmed that the correct materials have been employed at the correct locations in the work as described in the Specification.
8. All materials, including part and fully finished components, welding consumables and paints, etc. shall be identified and documented such that the Architect can confirm that all materials used comply with the Specification requirements.
9. All fabrication operations shall use processes, consumables and testing procedures, confirmed by suitable tests, that enable the Architect to confirm that the connections placed during fabrication, and if appropriate during erection, have mechanical properties and freedom from unacceptable defects sufficient to ensure that the Specification requirements are satisfied.
10. Fabrication and erection work shall be monitored by the Construction Manager to ensure that pieces are assembled correctly and when complete are compliant with the correct drawings and the Specification requirements.
11. Make available to the Construction Manager and Architect a detailed program of work so that he may witness significant stages in the fabrication process.
12. Painting and coatings materials and processes checks shall be as stated above and shall be monitored by the Construction Manager at such intervals necessary to confirm that the fabricator is carrying out this work properly and to the required levels of quality.

1.8 REFERENCES

A. Quality Assurance

1. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes. Such standards are made a part of Contract Documents by reference.
2. Conform to reference standard by date of issue current on original date indicated on Contract Documents.
3. Obtain copies of standards when required by Contract Documents.
4. Maintain copy of applicable standards at Project Site during the project, until Final Acceptance.
5. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.
6. The contractual relationship, duties, and responsibilities of the parties in the Contract, and the Architect, shall not be altered from Contract Documents by mention or inference otherwise in any reference document.

B. Reference Standards

1. Conflicting Requirements: Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, and uncertainties to Architect for decision before proceeding.

    a. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be

minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements. Refer uncertainties to Architect for decision before proceeding.

2. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents.

    a. Where copies of standards are needed for performance of a required construction activity, Contractor shall obtain copies directly from publication source.

1.9 MOCK-UP, PROTOTYPE, AND BENCHMARK

A. This Article specifies requirements for preparation of comparative installations the Work for the purpose of establishing visual quality and performance. Refer to individual specification sections for additional requirements.

B. Provide and coordinate assemblies both on and off the Project site, as scheduled in the technical specification sections, for Construction Manager, Architect’s and Owner’s review.

C. The Contractor shall coordinate the requirements for each sample installation with individual Subcontractors and their material suppliers.

D. Definitions

1. Mock-ups: Full scale three-dimensional sections utilizing final specified materials and final production techniques, constructed to be fully tested to ensure that the systems meet the performance requirements of the Specification by application of the maximum applied loads, climatic conditions, structural movements, and the like.

    a. Manufacture of materials/products for inclusion in the Work shall not commence until the Architect’s written acceptance of the mockup has been received.
2. Prototypes: Full scale three-dimensional installations using the final specified materials, constructed to illustrate the general visual intent. Prototypes are not intended to be incorporated into the Work.
3. Benchmarks: Sample installations using the final specific materials and methods, constructed to illustrate the general visual intent, installation methods, tolerances, and the like; for inspection and approval by the Architect.

    a. Benchmark installations may be incorporated into the Work if so approved by the Architect.

E. Submittals

1. Shop Drawings: Provide large-scale shop drawings for fabrication, installation and erection of all parts of each sample installation. Provide plans, elevations, and details of support, anchorage, connections and accessory items.
2. Samples: Refer to individual Specification Sections for submittal requirements of components and coordinate accordingly.

F. Quality Assurance

1. Design Modifications: Make design modifications to work only as required to meet performance requirements and to coordinate the work. Indicate proposed design modifications on shop

drawings. Maintain original design concept without altering profiles and alignments indicated.

PART 2 PRODUCTS

2.1 MATERIALS AND PRODUCTS - MOCK-UP, PROTOTYPE, AND BENCHMARK

A. Provide materials, components, and products for exterior wall assembly mock-ups, prototypes, and benchmarks and for specified interior construction components as specified in individual Specification Sections.

PART 3 EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Protect construction exposed by or for quality-control service activities.

B. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for limitations on utility interruptions and other work restrictions.
2. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Divisions 2 through 41 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
4. Division 31 Section "Dewatering" for disposal of ground water at Project site.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Sewer service from Owner’s existing system is available for use without metering and without payment of use charges, as required for construction operations.

C. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

D. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities. Permanently installed HVAC units are not to be used prior to owner occupancy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber and Plywood: Comply with requirements in Division 6 Section "Rough Carpentry."

B. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36/C 36M.

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

D. Paint: Comply with requirements in Division 9 painting Sections.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

F. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. No open flame heaters.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

H. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

J. Telephone Service: Provide temporary telephone service in a common-use facility for use by all construction personnel.

1. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Architect's office.
e. Engineers' offices.
f. Owner's office.
g. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Comply with requirements specified in SECTION 017419, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
1. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
2. Comply with Division 1 Section 017000, EXECUTION, for progress cleaning requirements.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

I. Existing Stair Usage: Use of Owner's existing stairs will not be permitted.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Division 1 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Comply with requirements specified in Division 2 Section "Tree Protection and Trimming."

E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary site fencing.
2. Division 31 Section "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

C. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.

4. Description of pruning to be performed.
5. Description of maintenance following pruning.

D. Qualification Data: For qualified arborist and tree service firm.

E. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

F. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

G. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.
d. Field quality control.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Planting Soil: Refer to Section 329200 and 329300.

B. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements. Previously used materials may be used when approved by Architect.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts ; with 0.177-inch- diameter top tension wire and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 4 feet.

C. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: 8 inch x 12 inch, tree protection

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.

1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where needed; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Division 31 Section "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered

immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Division 31 Section "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

3. Cut branches with sharp pruning instruments; do not break or chop.
4. Do not apply pruning paint to wounds.

B. Chip removed branches and dispose of off-site.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
2. Provide two new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
3. Plant and maintain new trees as specified in Division 32 Section "Plants."

C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 015720 - CONSTRUCTION INDOOR AIR QUALITY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Work of this Section includes, but is not limited to:

1. IAQ Management Goals
2. IAQ Management Plan
3. IAQ Management Plan Implementation

1.2 SUBMITTALS

B. Construction IAQ Management Plan highlighting the five requirements of the SMACNA IAQ Guideline for Occupied Buildings under Construction, 1995, Chapter 3 “Control Measures”.

C. Digital images or DVD videos documenting construction IAQ management measures implemented during construction such as duct protection measures and measures to protect on-site stored or installed absorptive materials from moisture.

D. Cut sheets of filtration media used during construction and installed immediately prior to occupancy with MERV values highlighted

E. Submit a letter from the Contractor describing building flush-out procedures including actual dates of building flush-out, hours of ventilation, ventilation rates, and indoor temperature and humidity levels.

1.3 IAQ MANAGEMENT GOALS

A. Owner has established that this Project shall prevent indoor air quality problems resulting from the construction process, to sustain long-term installer and occupant health and comfort.

C. Protect the ventilation system components during construction and cleanup of contaminated components after construction is complete.

D. Control sources of potential IAQ pollutants by controlling selection of materials and processes used in project construction.

E. With regard to these goals the Contractor shall develop, for Owner, Construction Manager and Architect’s review, an IAQ Management Plan for this Project

1.4 IAQ MANAGEMENT PLAN

A. Conduct a building flush-out or air testing at areas served by new air handling equipment, excluding the bowl. ~~Develop a Draft Indoor Air Quality (IAQ) Management Plan for the construction and preoccupancy phases of the building as follows: (1) during construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction 1995, Chapter 3, (2) Protect stored on-site or installed absorptive materials from moisture damage, and (3) conduct a building flush-out or air testing as indicated after construction ends and prior to occupancy.~~

1. The SMACNA IAQ Guidelines for Occupied Buildings under Construction provides an overview of air pollution associated with construction, control measures, construction process management,

quality control, communicating with occupants, and case studies. These guidelines can be accessed at www.smacna.org. Chapter 3 of the SMACNA Guidelines recommends Control Measures in five areas: HVAC protection, source control, pathway interruption, housekeeping, and scheduling. Review the applicability of each Control Measure and include those that apply in the Draft IAQ Management Plan.

a. HVAC Protection: Shut down the return side of the HVAC system whenever possible during heavy construction. If the system must remain operational during construction include the following strategies that apply:

1) Fit the return side of the HVAC system with temporary filters.
2) Isolate the return side of the HVAC system from the surrounding environment as much as possible (e.g., place all tiles for the ceiling plenum, repair all ducts and air handler leaks).
3) Damper off the return system in the heaviest work areas and seal the return system openings with plastic.
4) Upgrade the filter efficiency where major loading is expected to affect operating HVAC system.
5) Clean permanent return air ductwork per National Air Duct Cleaning Association standards upon completion of all construction and finish installation work.
6) Install new clean media just prior to substantial completion and occupancy that has a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2-1999.

b. Source Control: Propose the substitution of non-toxic formulations of materials that are generally the responsibility of the contractor such as caulks, sealants, and cleaning products.
c. Pathway Interruption: Prevent contamination of clean spaces. Include the following strategies that apply:

1) Use 100 percent outside air ventilation (when outside temperatures are between 55 deg F and 85 deg F (12.8 deg C and 29.4 deg C) and humidity is between 30 percent and 60 percent) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.
2) Erect some type of barrier between work areas or between the inside and outside of the building to prevent unwanted airflow from dirty to clean areas

d. Housekeeping: Reduce construction contamination in the building prior to occupancy through HVAC and regular space cleaning activities.

1) Store building materials in a weather tight, clean area prior to unpackaging for installation.
2) Check for possible damage to the HVAC, installed and stored building materials and assemblies from high humidity.
3) Clean all coils, air filters, and fans before testing and balancing procedures are performed.

e. Scheduling: Specify construction sequencing to reduce absorption of VOC's by materials that act as sinks or contaminant sources. Complete application of wet and odor-emitting materials such as paints, sealants, and coatings before installing sink materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings are installed.

2. Protect stored on-site or installed absorptive materials from exposure to moisture through precipitation, plumbing leaks, or condensation from the HVAC system to prevent microbial

contamination.

3. Conduct a building flush-out or air testing as indicated in requirements of LEED Interior Environmental Quality credits 3.1/3.2. MERV filters must be installed in HVAC equipment prior to occupation
    a. Once space is occupied it shall be ventilated at a minimum rate of 0.30 cfm/sq.ft. (0.09144 mmin./m) of outside air with ventilation beginning 3 hours prior to occupancy and continuing through occupancy until 14,000 cu.ft./sq.ft. (4,263 m / m) of outside air is delivered to the space.
    b. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 8 as determined by ASHRAE 52.2-1999.

B. Draft IAQ Management Plan Review Meeting: Once the Owner, Construction Manager and Architect have reviewed the Draft IAQ Management Plan and prior to construction at the site, schedule and conduct a meeting to review the Draft IAQ Management Plan and discuss procedures, schedules and specific requirements for IAQ during the construction and pre-construction phases of the building. Discuss coordination and interface between the Contractor and other construction activities. Identify and resolve problems with compliance to the requirements. Record minutes of the meeting, identify all conclusions reached and matters requiring further resolution.

1. Attendees: The Contractor and related Contractor personnel associated with the work of this section, including personnel to be in charge of the IAQ management program, Architect, Owner, Construction Manager and such additional personnel as the Architect or Owner deems appropriate.

C. Final IAQ Management Plan: Make any revisions to the Draft IAQ Management Plan agreed upon during the meeting identified in item (B) above and incorporate resolutions agreed to be made subsequent to the meeting. Submit the revised plan to the Owner, Construction Manager and Architect for approval within ten (10) calendar days of the meeting.

1.5 IMPLEMENTATION OF IAQ MANAGEMENT PLAN

A. Manager: Contractor shall be responsible for instructing workers and overseeing and the IAQ Management Plan for the Project.

B. Progress Meetings: Construction related IAQ procedures shall be included in the construction progress meeting agendas.

C. Preinstallation Meetings: Construction related IAQ procedures shall be included in the construction preinstallation meeting agendas.

D. Distribution: Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the Owner, Construction Manager, and Architect.

E. Instruction: Contractor shall provide on-site instruction of IAQ procedures and ensure that each participant in the construction process understands the importance of each IAQ Management Plan goal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 015720

SECTION 017000 - EXECUTION

PART 1 GENERAL

1.1 SUMMARY

A. Work of this Section consists of execution and closeout requirements, and includes but is not limited to the following:

1. Examination and Preparation
2. Execution
3. Cleaning
4. Starting and Adjusting
5. Protecting Installed Construction

B. Related Sections include the following:

1. Section 017310 Cutting and Patching
2. Section 017419 Construction Waste Management
3. Section 017810 Project Record Documents
4. Section 017820 Operation Maintenance Data
5. Section 018200 Demonstration and Training

1.2 EXECUTION

A. Execution Summary

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Execution Submittals

1. Submit Certified Surveys
2. Submit Final Property Survey
3. Submit Certificates certifying that location and elevation of improvements comply with requirements.
4. Submit Land Surveyor Qualifications

PART 2 PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned, and that meet requirements.

1. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examination

1. Existing Structures: Research, investigate, explore location of existing above and below-ground structures.
2. Existing Utilities: Research, investigate, explore location of existing above and below-ground utilities.
   a. Coordinate with “Dig Safe.”
3. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Preparation

1. Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with AHJ.
2. Take field measurements as required to fit the Work properly
3. Verify space requirements and dimensions.
4. Review Contract Documents with field conditions. Request necessary clarifications from Architect.

C. Construction Layout

1. Verify existing benchmark, control point, and property corner locations.
   a. Coordinate with Owner.
2. Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
3. Site Improvements: Locate and lay out site improvements, including pavements, grading and fill, utility slopes, and invert elevations
4. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical Work.
5. Record Log: Maintain a log of layout control Work.

D. Field Engineering

1. Reference Points: Locate and protect existing permanent benchmarks, control points, and similar reference points.
2. Site Benchmarks: Establish and maintain a minimum of two permanent site benchmarks on Project site, referenced to data established by survey control points.
3. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Installation

1. Locate the Work and components of the Work accurately, in correct alignment and elevation, plumb and level.
2. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
3. Obtain, distribute and use necessary templates.

4. Check, coordinate and ensure installed items correspond to approved Shop Drawings.
5. Anchors and Fasteners: Provide anchors and fasteners required to anchor each component securely in place, accurately located and with items being fastened aligned with other portions of the Work.
    a. Allow for building movement, including thermal expansion and contraction.
    b. Verify finish of exposed anchors and fasteners with Architect.
6. Joints: Make joints of uniform width.
    a. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect.
    b. Fit exposed connections together to form hairline joints.
7. Hazardous Materials: Use products, cleaners, and installation materials that are not hazardous.

F. Owner-Installed Products

1. Site Access: Provide access to Project site for Owner's construction forces.
2. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

    a. Construction Schedule: Coordinate mutually acceptable work schedules.
    b. Preinstallation Conferences: Both work forces are to attend and participate in pre-installation conferences covering portions of the Work that are to receive Owner's work.

3.2 PROJECT CLEANING

A. Construction Cleaning:

1. Clean Project site and Work areas broom clean daily.

    a. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
    b. Enforce requirements strictly.
    c. Dispose of materials lawfully.

2. Clean and protect construction in progress and adjoining materials already in place during handling and installation.

    a. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion

3. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period.

    a. Adjust and lubricate operable components to ensure operability without damaging effects.

4. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.3 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper

operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in SECTION 014000, QUALITY REQUIREMENTS.

3.4 PROTECTING INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Correction Of The Work

1. Repair or remove and replace defective construction.

a. Restore damaged substrates and finishes to previous condition.
b. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

2. Restore permanent facilities used during construction to their specified condition.
3. Repair components that do not operate properly.

a. Remove and replace operating components that cannot be repaired.

4. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017000

SECTION 017310 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:
1. Divisions 2 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
2. Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Electrical wiring systems.
8. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform

as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Equipment supports.
4. Piping, ductwork, vessels, and equipment.
5. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017310

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous construction waste.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.
2. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
3. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling a minimum of 80 percent by weight of total waste generated by the Work.

B. Salvage/Recycle Requirements: Goal is to salvage and recycle as much nonhazardous construction waste as possible including the following materials:

1. Construction Waste:

a. Site-clearing waste.
b. Masonry and CMU.
c. Lumber.
d. Wood sheet materials.
e. Wood trim.
f. Metals.
g. Roofing.
h. Insulation.
i. Carpet and pad.
j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for commencement of the Work.

B. Waste Reduction Report: Before request for Substantial Completion, submit the calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work. Include the following information in the report:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste recycled, both estimated and actual in tons.
5. Total quantity of waste recovered (salvaged plus recycled) in tons.
6. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop waste management plan using the contractors standard forms. ~~plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.~~

~~B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.~~

~~C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.~~

~~1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.~~
~~2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.~~
~~3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.~~

~~D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:~~

~~1. Total quantity of waste.~~
~~2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.~~
~~3. Total cost of disposal (with no waste management).~~
~~4. Revenue from recycled materials.~~
~~5. Savings in hauling and tipping fees that are avoided.~~
~~6. Handling and transportation costs. Include cost of collection containers for each type of waste.~~
~~7. Net additional cost or net savings from waste management plan.~~

~~E. Forms: Prepare waste management plan on forms similar to those included at end of Part 3.~~

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:

1. Almighty Waste (207-782-4000) and division of ERRCO, Epping NH (603-679-2626).
2. Pike Industries in Augusta, ME (207-782-2411) will recycle asphalt paving.
3. Cousineau Bark & Wood, Wilton, ME will chip clean dimensional lumber (without nails or paint).
4. Boralex, Inc., Livermore Falls, ME will recycle OSB, plywood and particleboard (no pressure treated materials)
5. Sandy River Waste, Route 2, Farmington, ME (207-778-3254) will recycle paper, cardboard, cans, bottles, some plastics.
6. Grimmel Industries, Topsham, ME (207-729-2191) will recycle metals.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees on-site or at landfill facility.

1. Comply with requirements in Division 32 Section "Plants" for use of chipped organic waste as organic mulch.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Division 32 Section "Plants." for use of clean sawdust as organic mulch.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 017419

~~(SAMPLE)~~

~~CONSTRUCTION WASTE MANAGEMENT PLAN~~

~~Company Name:~~ ~~Contact Person:~~
~~Telephone #:~~
~~Address:~~

~~Project Location:~~

~~Contractor:~~
~~Contact Person:~~
~~Telephone #:~~

~~Recycling Coordinators:~~
~~Architect:~~
~~Contact Person:~~
~~Telephone #:~~

Designated Recycling Coordinators: ___

Project Description:

Waste Management Goals:

- **This project will recycle or salvage for reuse a minimum of 80% by weight of the waste generated on-site.**
- **Waste reduction will be achieved through building design, and reuse and recycling efforts will be maintained throughout the construction process.**

Waste Prevention Planning:

- **Compliance with _____(name of recycling company)_____recycling requirements for businesses. Recyclables include:**
  - **newspaper**
  - **corrugated cardboard**
  - **white and colored office paper**
  - **glass bottles and jars**
  - **metal cans**

- **Compliance with _____(name of recycling company)_____bans, i.e. no disposal of tires, appliances, yard waste, mandatory recyclables, hazardous waste, batteries, fluorescent tubes, and large metal items.**
- **Project Construction Documents – Requirements for waste management which will be included in all work. The General Contractor will contractually require all subcontractors to comply with the _____(name of recycling company)_____recycling requirements. A copy of this Construction Waste Management Plan will accompany all Subcontractor Agreements and require subcontractor participation.**
- **The Construction Waste Reduction Plan shall be implemented and executed as follows and as on the chart:**
  - **Salvageable materials will be diverted from disposal where feasible.**
  - **There will be a designated area on the construction site reserved for a row of dumpsters each specifically labeled for respective materials to be received.**
  - **Before proceeding with any removal of construction materials from the construction site, Recycling Coordinators will inspect containers for compliance with _____(name of recycling company)_____requirements.**
  - **Wood cutting will occur in centralized locations to maximize reuse and make collection easier.**
  - **Hazardous waste will be managed by a licensed hazardous waste vendor.**

Communication & Education Plan:

- **The General Contractor will conduct an on-site pre-construction meeting with subcontractors. Attendance will be required for the subcontractor's key field personnel. The purpose of the meeting is to reinforce to subcontractor's key field employees the commitments made by their companies with regard to the project goals and requirements.**
- **Waste prevention and recycling activities will be discussed at the beginning of each weekly subcontractor coordination meeting to reinforce project goals and communicate progress to date.**
- **As each new subcontractor comes on site, the recycling coordinators will present him/her with a copy of the Waste Management Plan and provide a tour of the recycling areas.**
- **The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan.**
- **All recycling containers will be clearly labeled. Containers shall be located in close proximity to the building(s) under construction in which recyclables/salvageable materials will be placed.**
- **Lists of acceptable/unacceptable materials will be posted throughout the site.**
- **All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.**
- **Recycling coordinators shall inspect the containers on a weekly basis to insure that no contamination is occurring and precautions shall also be taken to deter any contamination by the public.**

Motivation Plan:

- **The project team will develop and publish a project mission statement that can be distributed to the subcontractors, attached to subcontracts, and posted at the jobsite.**

- **The General Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. A sign-off will be required by subcontractors attending the meeting that the project goals are understood. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the jobsite.**

Evaluation Plan:

- **The General Contractor will develop, update, and post at the jobsite a graph indicating the progress to date for achieving the project's waste recycling goal of XX% by weight of the total project waste stream.**

Expected Project Waste, Disposal, and Handling:

The following charts identify waste materials expected on this project, their disposal method, and handling procedures:

Material	Quantity	Disposal Method	Handling Procedure
Land clearing debris		Keep separate for reuse and or wood sale	Keep separated in designated areas on site.
Clean dimensional wood and palette wood		Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. Recycle at: _____	Keep separated in designated areas on site. Place in "Clean Wood" container.
Plywood, OSB, particle board		Reuse, landfill	Keep separated in designated areas on site. Place in "Trash" container.
Painted or treated wood		Reuse, landfill	Keep separated in designated areas on site. Place in "Trash" container.
Concrete		Recycle	
Concrete Masonry Units		Keep separate for re-use by on-site construction or by site employees	Keep separated in designated areas on site
Metals		Recycle at: Williston Drop Off Center	Keep separated in designated areas on site. Place in "Metals" container.
Paint		Reuse or recycle at _____	Keep separated in designated areas on site
Insulation		Reuse, landfill	
Flooring		Reuse, landfill	
Carpet and pad		Reuse or recycle with carpet manufacturer	
Glass		Glass Bottles: Recycle at: _____	Keep separated in designated areas on site. Place in "Glass/Plastic bottles/Metal Cans/Mixed Paper/ Cardboard" container

Material	Quantity	Disposal Method	Handling Procedure
Plastics		Plastic Bottles: Recycle at: _____ Plastic bags/scraps: Reuse, landfill	Keep separated in designated areas on site. Place in "Glass/Plastic bottles/Metal Cans/Mixed Paper/ Cardboard" container
Beverage		Recycle at: _____	Keep separated in designated areas on site. Place in "Glass/Plastic bottles/Metal Cans/Mixed Paper/ Cardboard" container
Cardboard		Recycle at: _____	Keep separated in designated areas on site. Place in "Glass/Plastic bottles/Metal Cans/Mixed Paper/ Cardboard" container
Paper and newsprint		Recycle at: _____	Keep separated in designated areas on site. Place in "Glass/Plastic bottles/Metal Cans/Mixed Paper/ Cardboard" container
TOTAL			

Waste Disposal: Contractor:
Contact:

- Name of landfill for disposal of non-recyclable waste:
  - Transfer Stations:
  - Landfills (ultimate disposal location):
- Landfill tipping fee: $XX / ton
- Estimate of waste for landfill disposal:

Recycling Calculation:

If all construction waste was disposed in landfill: XX lbs = XX tons x $XX/ton = $XX

With recycling: TOTAL = $XX

RECYCLING OPERATIONS

Action ***	Who	When
• Choose bins/collection methods		
• Order bins - oversee deliver		
• Site bins/collection sites for optimum convenience		
• Sort or process wood		
• Sort or process metal		
Sort or process cardboard		
Sort or process (material)		
Schedule material pickups/dropoffs		
Protect Materials from Contamination		
Document material pickups/dropoffs		

*** *Depending on the service option chosen, these may be the responsibility of either the field personnel, the hauler, a full-service recycling contractor, or the subcontractors.*

COMMUNICATION PLAN - Except for mandatory items (*), check other items intended to be used.

Action	Who	When	Completed
*Complete Construction Waste Mgmt. Plan**			
*Hold Orientation/Kick-off Meeting**			
*Update & Progress in Weekly Job-Site Meetings**			
Encourage Just-In-Time Deliveries			
Post Targeted Materials (Signage)			
Distribute Tip Sheets for Job-Site Personnel			
Post Goals/Progress (Signage)			

MOTIVATION PLAN - Except for mandatory items (*), check other items intended to be used.

Action	Who	When	Completed
Use formal agreements committing Subs to program			
Require Mis-Sorters to Re-Sort Bin			
Provide Stickers, T-Shirts, or Hats			
Public Recognition of Participating Subs			
Letters of Recognition			
Awards Luncheon			

EVALUATION PLAN - Except for mandatory items (*), check other items intended to be used.

Action	Who	When	Completed
Perform Short Form Waste Audit			
Perform Full Waste Audit			
Perform Mid-Course Assessment			
*Perform Monthly Cost and Materials Tracking**			
*Perform Final Evaluation**			

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Administrative provisions for Substantial Completion and for final acceptance.

1.02 SUBSTANTIAL COMPLETION

A. When Contractor considers work, or designated portion of work, is substantially complete, submit written notice with list of items to be completed or corrected.

B. Should Owner inspection find work is not substantially complete, Owner will promptly notify Contractor in writing, listing observed deficiencies.

C. Contractor shall remedy deficiencies and send a second written notice of substantial completion.

D. When Owner finds work is substantially complete, Owner will prepare a Certificate of Substantial Completion in accordance with provisions of the General Conditions.

1.03 FINAL COMPLETION

A. When Contractor considers work is complete, submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected.

4. Equipment and systems have been tested, adjusted and balanced and are fully operational.

5. Operation of systems has been demonstrated to Owner’s personnel.

6. Work is complete and ready for final inspection.

B. Should Owner inspection find work incomplete, Owner will promptly notify Contractor in writing, listing observed deficiencies.

C. Contractor shall remedy deficiencies and send a second certification of final completion.

D. When Owner finds work is complete, Owner will consider closeout submittals.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranties and bonds.

C. Spare parts and maintenance Materials.

D. Keys and keying schedule.

E. Evidence of payment and Release of Liens.

1.05 APPLICATION FOR FINAL PAYMENT

A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

1.06 GUARANTEE

A. Neither the final requisition for payment nor any provision in the Contract Documents nor partial or entire use or occupancy of the building by the Owner shall constitute an acceptance of work done in accordance with the Contract Documents or relieve the Contractor of liability in respect to express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within one year from the date of final acceptance unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.

B. Although subcontractors shall, throughout these Specifications, be required to provide guarantees for their respective work, the Contractor, in the last analysis, shall be responsible for all work and the guarantee thereof. In the case of disputes between subcontractors as to fault of problems, it is up to the Contractor to resolve these disputes or accept the cost of repair or replacement himself.

PART 2 to 3 – Not Used

END OF SECTION 017700

SECTION 017810 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include the following:
1. Division 1 Section "Closeout Procedures" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 41 for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up Record Prints.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
3. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

1.6 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

1.7 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 2 - EXECUTION

2.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017810

SECTION 017820 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation manuals for systems, subsystems, and equipment.
3. Maintenance manuals for the care and maintenance of products, materials, and finishes, and systems and equipment.

B. Related Sections include the following:
1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 1 Section "General Commissioning Requirements" for general requirements that apply to implementation of commissioning
4. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
5. Divisions 2 through 41 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 2 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.4 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.

3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to maintenance manuals, operation and maintenance manuals, manufacturer’s data, warranties and bonds.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017820

SECTION 018200 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. Related Sections include the following:
1. Divisions 2 through 41 Sections for specific requirements for demonstration and training for products in those Sections.
2. Division 1 Section "General Commissioning Requirements" for general requirements that apply to implementation of commissioning

1.3 SUBMITTALS

A. Instruction Program: Submit 3 copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit 2 complete training manual(s) for Owner's use.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Demonstration and Training Videotapes: Submit 2 copies within 7 days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name of Architect.
c. Name of Contractor.
d. Date videotape was recorded.

2. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
1. Fire-protection systems, including fire alarm and fire-extinguishing systems.
2. Refrigeration systems, including condensing units and distribution piping.
3. HVAC systems, including air-handling equipment air distribution systems and terminal equipment and devices.
4. HVAC instrumentation and controls.
5. Electrical service and distribution, including transformers switchboards panelboards and motor controls.
6. Lighting equipment and controls.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

a. System, subsystem, and equipment descriptions.
b. Performance and design criteria.
c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
a. Operations manuals.
b. Maintenance manuals.
c. Project Record Documents.
d. Identification systems.
e. Warranties and bonds.
f. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Operating instructions for conditions outside of normal operating limits.
    d. Sequences for electric or electronic systems.
    e. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

   1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral and demonstration performance-based test.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEOTAPES

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Videotape Format: Provide high-quality VHS color videotape in full-size cassettes.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

E. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

END OF SECTION 018200

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. BoD and OPR documentation are included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

1. Division 21 Section "Commissioning of Fire Suppression" for commissioning process activities for fire-suppression systems, assemblies, equipment, and components.
2. Division 22 Section "Commissioning of Plumbing" for commissioning process activities for plumbing systems, assemblies, equipment, and components.
3. Division 23 Section "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.
4. Division 25 Section "Commissioning of Integrated Automation" for commissioning process activities for integrated automation systems, assemblies, equipment, and components.
5. Division 26 Section "Commissioning of Electrical Systems" for commissioning process activities for electrical systems, assemblies, equipment, and components.
6. Division 28 Section "Commissioning of Electronic Safety and Security" for commissioning process activities for electronic safety and security systems, assemblies, equipment, and components.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the owner's requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. This document shall be developed by the commissioning authority.

C. CxA: Commissioning Authority.

D. Owner: **Cumberland County Civic Center (CCCC)** ~~**University of Maine (UM)**~~

E. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

F. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Mechanical Contractor, Controls Contractor, Testing, Adjusting, and balancing Contractor, Electrical Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect/Engineering: WBRC Architects-Engineers.
4. Construction Manger: Cianbro Corporation

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and each Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

D. **Cumberland County Civic Center (CCCC)** ~~**UM**~~ has the responsibility of authorizing the Architect/Engineer and Construction Manager to make any document and construction modification based on CxA observation issues noted.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a regular basis.

4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete construction checklists as Work is completed and provide to the Commissioning Authority on a timely basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings and keep minutes.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the BOD. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log. Provide to UM as generated.

G. Prepare and maintain completed construction checklist log.

H. Provide functional testing checklists for equipment and systems being commissioned.

I. Witness systems, assemblies, equipment, and component startup.

J. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

K. Review training requirements and verify training.

L. Provide close out report listing any outstanding issues for resolution.

M. Provide post occupancy site visits to review completed issues and verify system performance during seasonal changes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019113

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Sections include the following:

1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
3. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
4. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1. Coordinate with Owner, who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

B. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Refrigerant Recovery Technician Qualifications: Certified by a DEP-approved certification program.

C. Regulatory Requirements: Comply with governing DEP notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.7 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: Refer to the appendix for a description of hazardous materials that may be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

D. Storage of removed items or materials on-site is not permitted.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

   1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
   2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

   1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Do not overcut. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in a DEP-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Piers.
3. Foundation walls.
4. Slabs-on-grade.
5. Slabs-on-metal decking, including fill at stair pans.
6. High Strength, Non-Shrink Leveling Grout.

B. Products installed, but not furnished, under this Section include the following:
1. Leveling plates, anchor rods and other embedded steel items under Division 05 Metals. Provide survey of as-built anchor rods.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. Submit one hard copy and one electronic copy (PDF format) of all submittals required by this Section at full-size and full-scale. See Division 1 for additional submittal requirements.

B. Product Data: For each type of product indicated.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
1. Name and Location of the Concrete Supplier and Plant.
2. Concrete Test Reports using the same mix design, such as on past projects.
3. Indicate amounts of mixing water to be withheld for later addition at Project site.
4. The methods proposed for curing and protection of concrete.
5. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
    a. Sieve analyses for coarse, fine aggregates.

6. Product Data Material Certificates: For each of the following, signed by manufacturers:
   a. Cementitious materials.
   b. Admixtures.
   c. Steel reinforcement and accessories.
   d. Waterstops.
   e. Floor and slab treatments.
   f. Joint-filler strips.
   g. Repair materials.

D. Sawcut control joint layout plan:
1. On minimum 1/8" = 1'-0" scale plans, submit proposed size, spacing and layout of sawcut control joints in slabs on grade as well as additional construction joints.
   a. Coordinate with mandatory locations of construction joints as shown on the Drawings.

E. Construction joint layout plan:
1. On minimum 1/8" = 1'-0" scale plans, submit proposed spacing and locations of construction joints in foundation walls prior to submitting and reviewing reinforcing steel shop drawings.
2. On minimum 1/8" = 1'-0" scale plans, submit proposed spacing and locations of construction joints in slabs-on-metal deck prior to submitting and reviewing reinforcing steel shop drawings.

F. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. Bar placement drawings shall be detailed on wall elevations; detailing on plans with schedules is unacceptable and will be rejected.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project:
1. A supervisor qualified as ACI-certified Concrete Flatwork Finisher/Technician, and
2. Half of the personnel qualified as ACI-certified Concrete Flatwork Finisher/Technician, and
3. Remaining half of the personnel qualified as ACI-certified Concrete Flatwork Technicians.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction, control and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

F. The Owner will employ a qualified Testing Laboratory or Materials Engineer to make inspection tests during the course of work as specified herein and as otherwise considered necessary. Costs of all tests will be paid by the Owner.

G. All measuring, mixing, placing, and curing shall be subject to inspection by the Testing Laboratory and approval by the Architect. However, such inspection and approval shall in no way relieve the General Contractor of his responsibility to fulfill the requirements of this Contract.

H. Contractor shall cooperate in making tests and shall be responsible for notifying designated laboratory in sufficient time to allow making of cylinders at time of concrete placement.

I. Contractor shall provide a covered box large enough to contain four (4) standard sets of concrete cylinders. At temperatures below 60 degrees F., box shall be electrically heated to maintain inside temperature of 60 to 80 degrees F. Cylinders shall be covered with moist burlap until delivery to laboratory, 24 to 72 hours after molding.

J. Architect may require additional cylinders to be cured under field conditions when unusual conditions may tend to reduce concrete strength. Contractor shall cure these cylinders at the site under conditions that approximate the curing conditions of the representative concrete.

K. Architect has authority to order, for any strength of concrete, increase in cement content and mix redesign for remaining work if either:
    1. Average 7 day strength of any two (2) tests representing a particular design is less than 66% of specified strength; or
    2. Average 28 day strength of any two (2) tests representing a particular design strength is less than 90% specified strength.

L. Where concrete does not comply with these requirements, Architect shall have the right to require, at Contractor's expense:
    1. Test of hardened concrete cores according to ASTM C42.
    2. Load test on portion of structure affected.

M. Where tests show that concrete is below specified strength, or does not contain the required air entrainment, the Contractor shall remove all such concrete as directed by the Architect. Full cost of removal of non-compliant concrete and replacement with proper concrete shall be borne by the Contractor, as shall all work required by such remedial action.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.
b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

B. Dowel Bar Splicers: ASTM A 615/A 615M, Grade 60, deformed steel, size and type as indicated on the Drawings.

2.5 MISCELLANEOUS ANCHORS

A. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.053-inch- thick, steel sheet, galvanized after fabrication.
2. Available Products:

a. Duro-wall; D/A 100 with D/A 720-724
b. Heckman; #100 dovetail with 3/16 inch, #103 triangular tie.
c. Hohmann & Barnard; #305 with #315 tie.
d. Wire-Bond; Dovetail with #2102 triangle tie.

2.6 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I or II.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.

2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.7 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.8 WATERSTOPS

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products:

a. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
b. Concrete Sealants Inc.; Conseal CS-231.
c. Greenstreak; Swellstop.
d. Henry Company, Sealants Division; Hydro-Flex.
e. JP Specialties, Inc.; Earthshield Type 20.
f. Progress Unlimited, Inc.; Superstop.
g. TCMiraDRI; Mirastop.

2.9 FLOOR AND SLAB TREATMENTS (SEALERS)

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces with VOC not more than 100 g/L.

1. Products:

a. Burke by Edoco; Titan Hard.
b. ChemMasters; Chemisil Plus.
c. ChemTec International; ChemTec One.
d. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
e. Curecrete Distribution Inc.; Ashford Formula.
f. Dayton Superior Corporation; Day-Chem Sure Hard.
g. Euclid Chemical Company (The); Euco Diamond Hard.
h. Kaufman Products, Inc.; SureHard.

i. L&M Construction Chemicals, Inc.; Seal Hard.
j. Meadows, W. R., Inc.; Liqui-Hard.
k. Metalcrete Industries; Floorsaver.
l. Nox-Crete Products Group, Kinsman Corporation; Duranox.
m. Symons Corporation, a Dayton Superior Company; Buff Hard.
n. US Mix Products Company; US Spec Industraseal.
o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.
p. Approved Equal.

2.10 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

2.11 RELATED MATERIALS

A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, per ASTM D 2240.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3,500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 5 inches, plus or minus 1 inch
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size. Do not allow air content of trowel-finished floors to exceed 3 percent.

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed, exposed finished surfaces.
2. Class C, 1/2 inch for rough-formed non-exposed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete and anywhere else as shown on the Drawings.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 48 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing when overnight temperatures drop less than 50 deg F for 7 days after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement, unless more stringent requirements are shown on the Drawings.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Space vertical joints in walls as indicated on the Drawings. Locate joints away from column piers integral with walls, but in concealed locations where possible.
5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Grade: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random control cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated.

3.6 WATERSTOPS

A. Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed and Smooth-Rubbed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Apply to ALL concrete surfaces EXPOSED TO PUBLIC VIEW. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route or as specified on the construction plans. Coordinate required final finish with Architect before application.

3.10 GROUTING OF LEVELING PLATES

A. Grout Mixtures:
1. Use only approved prepackaged non-shrink grout for grouting under column base plates.
2. Where clearances are less than 2 inches or where the size and shape of the space make placement difficult, grout shall comprise only cement, non-metallic aggregate, sand, and water.
3. With either mix, use the minimum amount of water required to produce a flowable grout. Take care to avoid the use of excessive water which may cause segregation or bleeding.
4. Minimum ultimate compressive strength of grout shall be 5,000 psi at 7 days and 7,500 psi at 28 days.

B. Mixing:
1. The materials and water shall be mixed in a paddle type mortar mixer for not less than 3 minutes or it shall be thoroughly mixed by hand turning the entire mass over enough times to ensure even distribution of components.
2. Mix as close to the area to be grouted as possible. Provide adequate means to transport the mixed grout as quickly as possible, and in such manner as to prevent segregation.
3. Place grout within a period of 15 minutes or less after mixing. After the grout has been mixed, do not retemper by adding water.

C. Preparation:
1. Remove all defective concrete, laitance, dirt, oil, grease and loose material from the concrete foundation by bush hammering, chipping, or other approved means until sound, clean concrete is obtained. Leave the surface of the concrete reasonably rough but not so rough as to interfere with proper placing of the grout. Cover the area as completely as possible with a waterproof paper to prevent contamination prior to grouting.
2. Clean the bottom of the base plate or bearing plate of all dirt, oil, greases and loose materials. Align and level the plate in its final position and maintain in that position during grouting.
3. Take special care in hot or cold weather to ensure proper setting and gain of strength, in accordance with instructions of the manufacturer of the grouting material. Bring the concrete and plate to be grouted to a temperature of 65 to 75 degrees F., just prior to grouting.

4. Prior to grouting, clean the concrete surface by compressed air or other means. Saturate the surface of the concrete thoroughly with clean water. Remove free water just prior to placing the grout.
5. Take care that vibration of equipment or machinery operation nearby does not affect the normal set, strength and bond of the grout.

D. Grouting:
1. Place the grout quickly and continuously to avoid undesirable effects of overworking which might result in segregation, bleeding, or breaking down of initial set.
2. Grout may be cast in place, pressure grouted by gravity, or pumped.
3. Grout shall completely fill the space to be grouted. It shall be thoroughly compacted and free of air pockets.
4. Place grout from one side only and allow it to flow across to the open side to avoid air entrapment.

E. Finishing Unconfined Grout:
1. After the grout has acquired its initial set and will not sag, cut off all unconfined, exposed edges, leaving sloping "shoulders".

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments and/or floor coverings.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Concrete Construction is subject to the IBC's Chapter 17 requirements for "Structural Tests and Special Inspections." Contractor shall fully cooperate with timely scheduling and accessibility for these required tests and inspections. See Structural Drawing S0.02 for a Program and Schedule of all required tests and inspections.

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
3. A third inspection of Work failing to comply with specified requirements shall be done at Contractor's expense.
4. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

5. Contractor shall schedule testing and inspections and 48 hours in advance of scheduled concrete delivery.
6. Contractor shall not place any concrete encasing reinforcing steel, metal deck, shear studs, column base plates, or any other structural item until an Inspection has been made and the Work to be encased has been formally accepted.

A. Inspections, include but are not limited to the following:

1. Steel reinforcement placement.
2. Formwork geometry.
3. Anchor rods and other embedded steel items.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast sets of five standard cylinder specimens for each composite sample.
    b. Field cure one standard cylinder specimens and lab cure four standard cylinders.
6. Compressive-Strength Tests: ASTM C 39/C 39M:
    a. Test one field-cured specimen at 3-days
    b. Test one lab-cured specimen at 7-days.
    c. Test two lab-cured specimens at 28-days.
    d. If either of the 28-day break are below design strength, hold the fifth lab-cured specimen and test at 56-days, otherwise discard.
    e. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete

batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device are not permitted by Architect and cannot be used for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

END OF SECTION 033000

SECTION 033536 - CONCRETE FLOOR FINISHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the following:

1. Single application cure-seal-hardener for new concrete floors.
2. Single application sealer-hardener for existing concrete floors.

B. Related Section:

1. Cast-In-Place Concrete: Division 03 Cast-In-Place Concrete sections.

1.2 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Certificates: Manufacturer's certification that the installer is acceptable.

C. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Acceptable to the manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

C. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

1.5 PROJECT CONDITIONS

A. Environmental limitations:

1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.

B. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Cure-Seal-Hardener: Ashford Formula, a water-based chemically reactive penetrating sealer and hardener that seals by densifying concrete so that water molecules cannot pass through but air and water vapor can, and allows concrete to achieve full compressive strength, minimizing surface crazing and eliminating dusting.

1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.
2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
3. Hardening: As follows when tested in accordance with ASTM C39:

    a. After 7 Days: An increase of at least 40% over untreated samples.
    b. After 28 Days: An increase of at least 38% over untreated samples.

4. Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C1028.
5. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.
6. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Do not use frozen material. Thaw and agitate prior to use.

D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.3 APPLICATION

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

B. All work must be performed by an applicator certified by the manufacturer. Certification credentials are required.

C. New Concrete: Apply cure-seal-hardener to new concrete as soon as the concrete is firm enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.

1. Spray on at rate of 200 ft^2/gal.
2. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 minutes without allowing it to dry out or become slippery. In hot weather, slipperiness may appear before the 30 minute time period has elapsed. If that occurs, apply additional cure-seal-hardener as needed to keep the entire surface in a non-slippery state for the first 15 minutes. For the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.
4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-seal-hardener residue.
5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.
6. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.

D. Existing Concrete: Apply cure-seal-hardener only to clean bare concrete.

1. Thoroughly remove previous treatments, laitance, oil and other contaminants.
2. Saturate surface with cure-seal-hardener; re-spray or broom excess onto dry spots.
3. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 - 40 minutes.
4. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.
5. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all cure-seal-hardener residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.
6. If water is not available, remove residue using squeegee.

3.4 PROTECTION:

A. Protect installed floors for at least 3 months until chemical reaction process is complete.

1. Do not allow traffic on floors for 3 hours after application.
2. Do not allow parking of vehicles on concrete slab.
3. If vehicles must be temporarily parked on slab, place dropcloths under vehicles during entire time parked.
4. Do not allow pipe cutting using pipe cutting machinery on concrete slab.
5. Do not allow temporary placement and storage of steel members on concrete slabs.
6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
7. Clean floor regularly in accordance with manufacturer's recommendations.

END OF SECTION 033536

SECTION 033660 - CHEMICALLY STAINED CONCRETE FLOOR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chemically stained concrete floor finish.
2. Sealer.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical data sheets and installation instructions for each product specified.

B. Samples for Selection: Manufacturer's color charts showing full range of colors available.

C. Qualification Data: For firms indicated in "Quality Assurance" Article, including lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 3 years experience in staining applications and successfully completed not less than 6 projects comparable in scale and complexity.

B. Source Limitations: Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

C. Mockups:

1. At location on Project, prepare mockup 4 by 4 feet for review and approval.
2. Construct mockup using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in mockup panels.
3. Mockup shall be stained and sealed by the individual workers who will actually be performing the work for the Project.
4. Obtain written approval of the mockup from Architect before start of work.
5. Retain approved mockup through completion of the Work for use as a quality standard for finished work.
6. Remove mockup when directed

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers with legible manufacturer's identification and information.

B. Store specified products in conditions recommended by the manufacturer.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Maintain an ambient temperature of between 50° and 90° F during application and at least 48 hours after application.

B. Protection: Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed stain work from moisture or contamination.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: CustomerCare@prosoco.com

2.2 MATERIALS

A. Chemical Stains: Consolideck® GemTone Stain is a non-flammable, water-reducible formulation that penetrates and colors cementitious surfaces without risk of etching the surface or corroding adjacent architectural metals. Use GemTone Stain alone or in layers over grey, integrally colored, acid-stained or color-hardened concrete to produce an unlimited range of color hues. GemTone Stains are compatible with Consolideck® lithium-silicate hardeners and densifiers.

1. Colors: As selected by Architect from manufacturer's full range.

B. Sealers: Consolideck® LSGuard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Contractor shall examine areas and conditions under which work will be performed and identify conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before applying, read “Preparation” and “Safety Information” sections in the Manufacturer’s Product Data Sheet. Refer to the Product Data Sheet for additional information about application.

B. Dilution: Mix one 12-oz package of GemTone Stain with one-gallon of fresh water to make one gallon of ready-to-use GemTone Stain. Prepared GemTone Stain must be applied within 24-hours. To reduce color intensity, dilute prepared GemTone Stain with up to 2-parts fresh water.

C. Mask neighboring surfaces as needed to control color bleeding.

3.3 APPLICATION OF CHEMICAL STAIN

A. When spray applying, maintain a consistent flow rate and spray pattern. When triggering or releasing sprayer, direct spray tip into a container to minimize dripping.

1. Diamond grind and polish concrete floor to equivalent of #200 grit resin diamonds.
2. Clean the floor with a floor-scrubbing machine and fresh water and allow to dry.
3. Lightly wet a clean microfiber pad with prepared GemTone Stain.
4. Using a low-pressure sprayer, apply enough prepared GemTone Stain to wet the surface without producing puddles. Do not over apply. Use a small bucket or rag to collect drips when not spraying.
5. Using the microfiber pad prewet with prepared GemTone Stain, spread the spray-applied GemTone Stain to ensure uniform wetting and color distribution. Continue spray-application and maintain a wet edge. Work the color into the surface to minimize streaks and patterns.
6. Allow to dry thoroughly, 60 minutes minimum. Do not walk on freshly stained floor.

B. Application of up to three thin coats of GemTone Stain produces better color intensity than one heavy coat.

1. Using a floor scrubbing machine and fresh water, remove excess stain residue. Allow to dry.
2. If more color or color variations are desired, apply a second coat of GemTone Stain pursuant to Steps 1-6 above. Each coat must dry for one hour minimum prior to using an auto-scrubber.
3. Using a floor scrubbing machine and fresh water, remove excess stain residue. Allow to dry.
4. Using a low-pressure sprayer, apply a single coat of Consolideck® LS®. Apply sufficient material to wet the surface without producing puddles. Use a clean, soft-bristle push broom or microfiber pad to spread the LS® evenly and achieve uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary.
5. Allow the treated concrete floor to dry. Proceed to Application Instructions for Sealing the concrete floor.

3.4 APPLICATION OF SEALER

A. Surfaces colored with Consolideck® GemTone Stain and hardened with Consolideck® LS® must be sealed within 8-hours using Consolideck® LSGuard.

1. Lightly prewet a clean microfiber pad with Consolideck® LSGuard® and wring out excess. Microfiber pad should be damp.
2. Using a clean, pump-up spraying fitting with a 0.5 gpm spray tip, apply a light, fine spray of LSGuard® to a small section of the floor.
3. Using the microfiber pad damp with LSGuard, spread the spray-applied product to produce a thin, even coating. Spread the product as far as possible while maintaining a wet edge. Stop spreading once drying begins. Avoid overlapping.
4. Allow the floor to dry tack free, typically 20-60 minutes.
5. After the floor is dry, burnish using a high-speed burnisher fitted with a polishing pad for high-gloss finishes.
6. Repeat Sealing Application Instructions #1-5 up to three times to achieve desired finish and surface gloss.

3.5 CLEANUP

A. Before product dries, clean tools and equipment with soap and water.

3.6 PROTECTION

A. Protect floor from traffic for at least 72 hours after final application of sealer.

END OF SECTION 033660

CONSOLIDECK®
HIGH PERFORMANCE CONCRETE

GemTone Stain

penetrating translucent color dye for concrete floors

SCS CERTIFIED
INDOOR ADVANTAGE
GOLD
SCIENTIFIC CERTIFICATION SYSTEMS
SCS-IAQ-01606

OVERVIEW

Consolideck® GemTone Stain transforms dull grey concrete into decorative, low-maintenance finished concrete flooring. Apply penetrating GemTone Stains to concrete before hardening/densifying with Consolideck® LS®, then apply Consolideck® LSGuard® to enhance the color with a high-gloss protective finish.

This non-flammable, water-reducible formulation penetrates and colors cementitious surfaces without risk of etching the surface or corroding nearby architectural metals. Use GemTone Stains alone or in layers over grey, integrally colored, acid-stained or color-hardened concrete for an unlimited range of colors.

GemTone Stains are liquid concentrates in pre-measured 12-oz packages. Adding one package to one gallon of fresh water makes a vibrant concrete stain. Concentrated GemTone Stain minimizes freight, handling, storage and container disposal costs.

SPECIFICATIONS

For all PROSOCO product specifications visit www.prosoco.com and click on "SpecBuilder" or "Solution Finder."

ADVANTAGES

- Vibrant colors turn gray concrete into colorful decorative concrete.
- Adds color & depth to diamond-polished concrete.
- Enhances integrally colored, acid stained, color hardened or concrete colored with solvent-based dyes.
- Ideal for use under Consolideck® lithium-silicate hardeners/densifiers.
- VOC Compliant. Non-Flammable. Non-Toxic. Non-corrosive. Low Odor. Suitable for use in occupied spaces.
- Contains no harmful acids. Will not etch polished concrete surfaces or corrode surrounding metals. No need to neutralize.
- Easy application and fast drying lets color be added and blended.
- Produces consistent gem-like color on any age concrete floor.
- Penetrates deeper than acid stains or conventional color pigments. Will not peel or flake.
- Standard colors may be intermixed to create an unlimited number of color variations.
- Additional coats may be applied to improve color depth, uniformity and intensity.

Limitations

- GemTone Stain is translucent. Variations in the concrete before staining will still be noticeable after staining.
- Not intended for exterior applications or surfaces exposed to intense ultraviolet light.
- Not for use on surfaces exposed to standing water.

REGULATORY COMPLIANCE

VOC Compliance

Consolideck® GemTone Stains are compliant with the following national, state and district AIM VOC regulations

- [X] US Environmental Protection Agency
- [X] California Air Resources Board SCM Districts
- [X] South Coast Air Quality Management District
- [X] Maricopa County, AZ
- [X] Northeast Ozone Transport Commission

TYPICAL TECHNICAL DATA

FORM	colored liquid, slight odor
SPECIFIC GRAVITY	0.90 – 1.10
pH	Not applicable
WT/GAL	8.34 lbs
ACTIVE CONTENT	Not applicable
TOTAL SOLIDS	Not applicable
VOC CONTENT	< 100 g/L
FLASH POINT	> 200°F (> 93°C) ASTM D 3278
FREEZE POINT	32°F (0°C)
SHELF LIFE	2 years in tightly-sealed, unopened container

GemTone Stain

PREPARATION

Protect people, vehicles, property and nearby surfaces not to be treated from contact with the product or over spray. Over spray and spills may be difficult or impossible to remove. Use plastic sheeting or other proven protective material, fastened with blue painters tape or other tape that won't leave adhesive residues.

The concrete surface must be clean and dry. Contaminants may prevent penetration of the stain. Remove all curing compounds, dirt, dust and other contaminants with the appropriate Consolideck® surface preparation cleaner.

After cleaning, spray clean water lightly to confirm the surface wets uniformly. If it doesn't, more preparation is needed.

Freshly placed concrete must be at least 21 days old before coloring. Once concrete is placed, protect the surface from all construction activities before staining. Do not store building materials on newly placed concrete surfaces. Avoid standing water.

Surface and Air Temperatures

For best results keep air flow and surface temperatures consistent during application. Surface and air temperatures should be 50–90°F (10–32°C).

Equipment

Use a clean, low-pressure sprayer, microfiber pads, brush, roller or rags to apply GemTone Stain. Wear "spiked" shoes when walking in wet GemTone Stain.

Storage and Handling

Store in a cool, dry place. Apply product within 24 hours of dilution.

Published shelf life assumes storage of unopened containers in a dry place. Maintain temperature of 50–90°F (10–32°C). Keep from freezing. Do not crush or tear. Dispose of unused product and container in accordance with local, state and federal regulations.

APPLICATION

Visit www.consolideck.com for the most up-to-date application procedures and tips.

Before use, read "Preparation" and "Safety Information." ALWAYS TEST each surface for suitability and desired results before overall application. Use the following application instructions. Let surface dry thoroughly before inspection and approval.

Include representative imperfections in the test area. Floor composition and surface finish affect final color. GemTone Stains are translucent and will not mask or hide imperfections in treated surfaces.

Dilution & Mixing

GemTone Stain is designed for dilution with fresh water. Mix one 12-oz package with one gallon fresh water to make one gallon of ready-to-use GemTone Stain. Apply product within 24 hours of dilution.

To reduce color intensity, dilute prepared GemTone Stain with up to 2 parts fresh water.

When desirable, GemTone Stain may be diluted with acetone to produce a ready-to-use stain. Use appropriate ventilation, safety equipment and job-site controls when diluting with acetone.

Blend GemTone Stains for an unlimited range of colors.

Typical Coverage Rates

Coverage rate varies with concrete quality and porosity.

First Application:

- 400–800 square feet per US gallon
- 37–74 square meters per US gallon
- 9–18 square meters per liter

Additional Applications:

- 500–1,000 square feet per US gallon
- 46–92 square meters per US gallon
- 12–24 square meters per liter

ALWAYS TEST

ALWAYS TEST a small area of each surface to confirm suitability and desired results before starting overall application. Test with the same equipment, recommended surface preparation and application procedures planned for general application.

Application Instructions: Color

1. Diamond grind and polish the surface to the equivalent of #200 grit resin diamonds.
2. Clean the floor with a floor-scrubbing machine and fresh water. Let the floor dry.
3. Lightly wet a clean microfiber pad with the prepared GemTone Stain.
4. Apply the prepared GemTone Stain to the clean, dry concrete floor using a low-pressure sprayer with a conical spray pattern. Wet the surface without producing puddles. Do not over apply. Use a small bucket or rag to collect drips when not spraying.
5. Using the wet microfiber pad, immediately spread the spray-applied GemTone Stain to ensure uniform wetting and color distribution. Continue spray-applying. Maintain a wet edge. Work the color into the surface to minimize streaks and patterns. Two people – one spraying and one spreading – get best results.
6. Do not walk on the freshly stained surface. Let the floor dry thoroughly, 60 minutes minimum.

If you're NOT polishing further, begin Option 1.

If you ARE polishing further, start Option 2.

Option 1: NO more polishing

7. Use a floor scrubbing machine and fresh water to remove excess stain residue. Let the wet floor dry.
8. For more color or color variations, apply a second coat of GemTone Stain as described in steps 1–6. Up to three thin coats produce better results than one heavy coat. Each coat must dry for one hour minimum prior to auto-scrubbing.

GemTone Stain

9. Use a floor-scrubbing machine and fresh water to remove excess stain residue. Let the wet floor dry.
10. Apply a single coat of Consolideck® LS® using a low-pressure sprayer. Apply sufficient material to wet the surface without producing puddles. Use a clean, soft-bristle push broom or microfiber pad to spread product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary.

NOTE: Allowing excess LS® to puddle on the floor will extend dry times and create white residues which must be removed immediately. Call the Consolideck® Hotline at 866.363.4567 for removal instructions.

11. Let the treated floor dry. Start Application Instructions for Sealing.

Option 2: MORE Polishing

7. Remove excess stain residue with a floor scrubbing machine and fresh water. Let the wet floor dry.
8. Dry-polish to the equivalent of #400 resin diamonds. Polish until all scratch patterns are gone.
9. Clean the floor with a floor-scrubbing machine and fresh water. Let the wet floor dry.
10. For more color or color variations, apply a second coat of GemTone Stain as described in steps 1–6. Up to three thin coats produce better results than one heavy coat. Each coat must dry for one hour minimum prior to auto-scrubbing.
11. Use a floor-scrubbing machine and fresh water to remove excess stain residue. Let the wet floor dry.
12. Apply a single coat of Consolideck® LS® using a low-pressure sprayer. Apply sufficient material to wet the surface without producing puddles. Use a clean, soft-bristle push broom or microfiber pad to spread product evenly and ensure uniform wetting. Avoid spreading once drying begins. Scrubbing is not necessary. Allow treated surfaces to dry.

NOTE: Allowing excess LS® to puddle on the floor will extend dry times and create white residues which must be removed immediately. Call the Consolideck® Hotline at 866.363.4567 for removal instructions.

13. Dry polish to your desired finish and exposure. Start Application Instructions for Sealing.

Application Instructions: Sealing

Surfaces colored with GemTone Stain and hardened with Consolideck® LS® must be sealed within 8-hours using Consolideck® LSGuard® or other approved Consolideck® coating.

If using another approved Consolideck® coating for sealing, follow product data sheet application instructions. For sealing with Consolideck® LSGuard® use the following application instructions.

1. Lightly wet a clean microfiber pad with LSGuard® and wring out excess, leaving pad damp.
2. Apply a light, fine spray of LSGuard® to a small section of the floor using a clean, pump-up sprayer fitted with a 0.5 gpm spray tip.
3. Use the damp microfiber pad and firm downward pressure to immediately spread the product to produce a thin, even coating. Spread the product as far as possible. Maintain a wet edge. Properly applied, LSGuard® dries quickly. Stop spreading once drying begins. Avoid overlapping.
4. Let the floor dry tack free, typically 20–60 minutes.
5. Once dry, burnish. Use a high-speed burnisher fitted with a Consolideck® Heat High-Performance Burnishing Pad or equivalent polishing pad for high-gloss finishes. In addition to smoothing and polishing, high-speed burnishing heats the LSGuard® to help the treatment fuse and bond with the concrete for increased durability and longevity. Surface temperatures immediately behind the burnisher must reach 90°F (32°C).
6. Repeat "Sealing" steps 1–5 up to three times to achieve the finish and surface gloss desired.

BEST PRACTICES

Before applying color, use a light water spray to confirm surfaces wet uniformly. If surface does not wet uniformly, additional surface preparation may be needed.

Harden unpolished/polished concrete with Consolideck® LS® after staining. Seal polished concrete with Consolideck® LSGuard® after staining and hardening/densifying.

Wet or dry grind before applying GemTone Stain. Dry grind or dry polish only after applying GemTone Stain.

Thoroughly neutralize and rinse acid-stained concrete before applying GemTone Stain.

Mask neighboring surfaces as needed to control color bleeding. For best results, spread evenly using a microfiber pad.

When desirable, GemTone Stain may be diluted with acetone to produce a ready-to-use stain. Use appropriate ventilation, safety equipment and job-site controls when diluting with acetone.

When spraying, maintain consistent flow rate and spray pattern. When triggering or releasing sprayer, direct spray tip into a container to minimize dripping.

Two thin applications of GemTone Stain achieve better color intensity than one heavy coat. When diamond polishing, apply second coat of stain immediately before final dry polishing step.

Thoroughly rinse application equipment with fresh water between colors and after final application.

Never go it alone. If you have problems or questions, contact your local PROSOCO distributor or field representative. Or call PROSOCO technical Customer Care, toll-free at 800-255-4255.

GemTone Stain

Cleanup
Before product dries, clean tools and equipment with soap and water.

Final Results
The floor is ready to use when dry.

Protect freshly stained, hardened and sealed surfaces from contact with water or other liquids for 72 hours.

Smooth, hardened concrete surfaces should show reduced water absorption and the desired sheen when dry. Maximum water resistance develops over 7 days.

Maintenance
Clean daily using a microfiber pad or dry dust mop. Dry-buff with a high-speed burnisher to refresh gloss.

Maintain the floor with Consolideck® LSKlean Super Concentrate or Consolideck® DailyKlean. These cleaners were developed to enhance the long-term performance of the finished concrete floor.

Do not use acidic or alkaline cleaners. Though Consolideck® LSGuard® improves the resistance of concrete surfaces to staining, acid concentrates and acidic foods may etch the floor and leave residual stains. Clean all spills quickly to minimize chances for damage.

For additional protective treatments or surface coatings, call Customer Care for recommendations toll-free at1-800-255-4255.

SAFETY INFORMATION
Consolideck® GemTone Stain is a water-carried product. Use appropriate safety and job site controls during application and handling. Read the full label for precautionary instructions before use.

First Aid
Ingestion: Drink large quantities of water or milk. DO NOT induce vomiting. Seek medical attention immediately.

Eye Contact: Remove contact lenses. Immediately flush eyes for 15 minutes in clear running water while holding eyelids open. Seek medical attention immediately.

Skin Contact: Wash contacted area with soap and water. DO NOT attempt to neutralize with chemical agents. If irritation persists, seek medical attention.

Inhalation: Remove affected person to fresh air. Wash mouth and nasal passages with water repeatedly. If breathing difficulties persist, seek medical attention.

24-Hour Emergency Information:
INFOTRAC at 800-535-5053

WARRANTY
The information and recommendations made are based on our own research and the research of others, and are believed to be accurate. However, no guarantee of their accuracy is made because we cannot cover every possible application of our products, nor anticipate every variation encountered in masonry surfaces, job conditions and methods used. The purchasers shall make their own tests to determine the suitability of such products for a particular purpose.

PROSOCO, Inc. warrants this product to be free from defects. **Where permitted by law, PROSOCO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of merchantability or fitness for particular purpose.** The purchaser shall be responsible to make his own tests to determine the suitability of this product for his particular purpose. PROSOCO's liability shall be limited in all events to supplying sufficient product to re-treat the specific areas to which defective product has been applied. Acceptance and use of this product absolves PROSOCO from any other liability, from whatever source, including liability for incidental, consequential or resultant damages whether due to breach of warranty, negligence or strict liability. This warranty may not be modified or extended by representatives of PROSOCO, its distributors or dealers.

CUSTOMER CARE
Factory personnel are available for product, environment and job-safety assistance with no obligation. Call 800-255-4255 and ask for Customer Care - technical support.

Factory-trained representatives are established in principal cities throughout the continental United States. Call Customer Care at 800-255-4255, or visit our web site at www.prosoco.com, for the name of the Consolideck® representative in your area.

SECTION 034500 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Architectural precast concrete cladding units.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing connection anchors in concrete.

1.3 DEFINITIONS

A. Design Reference Sample: Sample of approved architectural precast concrete color, finish and texture, preapproved by Architect.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.

C. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at building corners.
5. Indicate separate face and backup mixture locations and thicknesses.
6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.

8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
9. Include plans and elevations showing unit location and sequence of erection for special conditions.
10. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
11. Indicate relationship of architectural precast concrete units to adjacent materials.
12. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
13. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
14. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
2. Samples for each thin-brick unit required, showing full range of color and texture expected. Include Sample showing color and texture of joint treatment.

a. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
b. Grout Samples for Verification: Showing color and texture of joint treatment.

E. Delegated-Design Submittal: For architectural precast concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Material Certificates: For the following items:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Structural-steel shapes and hollow structural sections.

C. Material Test Reports: For aggregates.

D. Preconstruction test reports.

E. Source quality-control test reports.

F. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.

B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

F. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of two sample panels approximately 12 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1. Locate panels where indicated or, if not indicated, as directed by Architect.
2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove sample panels when directed.

G. Mockups: After sample panel approval but before production of architectural precast concrete units, construct full-sized mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. As part of the masonry mockup, include architectural precast concrete complete with anchors, connections, flashings, and joint fillers.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

1.8 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.

B. Support units during shipment on nonstaining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units.

B. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.

C. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Basic Wind Speed: 100 mph.
    b. Importance Factor: 1.15.
    c. Exposure Category: B.

2. Seismic Loads: As indicated on the Structural Drawings.
3. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:

    a. Upward and downward movement of 1/2 inch.

4. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of 120 deg F.

2.2 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.3 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: Uniformly graded.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.

D. Coloring Admixture: ASTM C 979/C 979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
9. Corrosion Inhibiting Admixture: ASTM C 1582/C 1582M.

2.5 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.

D. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65.

E. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.

F. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563; and hardened carbon-steel washers, ASTM F 436.

G. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

H. Welding Electrodes: Comply with AWS standards.

2.6 BEARING PADS

A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.
2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.7 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.8 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use a single design mixture for units with more than one major face or edge exposed.
2. Where only one face of unit is exposed use either a single design mixture or separate mixtures for face and backup.

B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

E. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.10 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces exposed to view in the finished work.
2. Edge and Corner Treatment: As indicated on the drawings.

2.11 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcing steel and prestressing strands to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

H. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

J. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

K. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.

L. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

N. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.12 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:

1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:

    a. 10 feet or under, plus or minus 1/8 inch.
    b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
    c. 20 to 40 feet, plus or minus 1/4 inch.
    d. Each additional 10 feet, plus or minus 1/16 inch.

2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:

    a. 10 feet or under, plus or minus 1/4 inch.
    b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
    c. 20 to 40 feet, plus or minus 3/8 inch.
    d. Each additional 10 feet, plus or minus 1/8 inch.

3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
4. Rib Thickness: Plus or minus 1/8 inch.
5. Rib to Edge of Flange: Plus or minus 1/8 inch.
6. Distance between Ribs: Plus or minus 1/8 inch.
7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches or 1/2 inch total, whichever is greater.
8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.
10. Dimensions of Haunches: Plus or minus 1/4 inch.
11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
13. Bowing: Plus or minus L/360, maximum 1 inch.
14. Local Smoothness: 1/4 inch/10 feet.
15. Warping: 1/16 inch/12 inches of distance from nearest adjacent corner.
16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.

C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.

1. Weld Plates: Plus or minus 1 inch.
2. Inserts: Plus or minus 1/2 inch.
3. Handling Devices: Plus or minus 3 inches.

4. Reinforcing Steel and Welded Wire Reinforcement: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
7. Location of Rustication Joints: Plus or minus 1/8 inch.
8. Location of Opening within Panel: Plus or minus 1/4 inch.
9. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
10. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.

2.13 FINISHES

A. Exposed faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:

1. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
2. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.

B. Finish exposed surfaces of architectural precast concrete units with smooth, steel-trowel finish.

C. Finish unexposed surfaces of architectural precast concrete units with as cast finish.

2.14 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6, ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712.

B. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.

C. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M and ACI 318.

1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
2. Test cores in an air-dry condition.
3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:

a. Project identification name and number.
b. Date when tests were performed.
c. Name of precast concrete fabricator.

d. Name of concrete testing agency.
e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

D. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

E. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.

1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.

C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
4. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
5. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:

a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
c. Twist-off Tension Control Bolt: ASTM F 1852.
d. Direct-Tension Control Bolt: ASTM F 1852.

3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.

F. Grouting or Dry-Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
3. Top Elevation from Nominal Top Elevation: As follows:

a. Exposed Individual Panel: Plus or minus 1/4 inch.
b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.

4. Support Elevation from Nominal Support Elevation: As follows:

a. Maximum Low: 1/2 inch.
b. Maximum High: 1/4 inch.

5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
9. Maximum Joint Taper: 3/8 inch.
10. Joint Taper in 10 Feet: 1/4 inch.
11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 REPAIRS

A. Repair architectural precast concrete units if permitted by Architect. Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Face brick.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Miscellaneous masonry accessories.
8. Cavity-wall insulation.

B. Related Sections:

1. Section 047200 "Cast Stone Masonry" for furnishing cast stone trim.
2. Section 055000 "Metal Fabrications" for furnishing steel lintels for unit masonry.
3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
4. Weep holes and vents.
5. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties and material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.
d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Reinforcing bars.
6. Joint reinforcement.
7. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years experience.

B. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

E. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for typical exterior wall in sizes approximately 60 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
    c. Include metal studs, sheathing, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
3. Clean exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates or setting beds. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with the following requirements:

1. Cold-Weather Construction: When the anticipated daytime low temperature is within the limits indicated, use the following procedures:

a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.

b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Heat masonry units to 40 deg F. Maintain mortar and grout above freezing until used in masonry. Use heat on both sides of walls under construction.
c. 25 to 20 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F.
d. 20 deg F and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F.

2. Cold-Weather Protection: When the anticipated daytime low temperature is within the limits indicated, coordinate with the General Contractor to provide the following protection. This is in addition to construction procedures specified above:

a. 40 to 32 deg F: Cover masonry with insulating blankets for 48 hours after construction.
b. 32 deg F and Below: Provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 72 hours after construction.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. Hot-Weather Requirements: Coordinate with the General Contractor to protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. CMUs: ASTM C 90.

1. Density Classification: Normal weight.
2. Curing: Allow masonry units to cure 28 days to permit drying shrinkage before laying.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick: Facing brick complying with ASTM C 216.

1. Grade: SW.
2. Type: FBS.
3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 8250 psi.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
1. Size (Actual Dimensions): 3-5/8 inches wide wide by 2-1/4 inches high by 7-5/8 inches long.
2. Application: Use where brick is exposed unless otherwise indicated.
3. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.

    a. Morin Brick; Brushed Velour, narrow flashed range.

2.5 MORTAR AND GROUT MATERIALS

A. General: Mortar and grout may be provided in one of two options; field mix of Portland cement, lime and sand or with specified Portland Cement-Lime Mix.

B. Portland Cement: ASTM C 150, Type I or II.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207, Type S.

1. Available Products:

a. Blue Circle Cement, Inc.: Eaglebond High Strength Type "S".
b. Ciment Quebec, Inc.: Portland and Lime / Type S.
c. Dragon Cement and Concrete: Type S Masonry Cement.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Davis Colors; True Tone Mortar Colors.
b. Solomon Colors, Inc.; SGS Mortar Colors.

F. Aggregate for Mortar: ASTM C 144.

G. Aggregate for Grout: ASTM C 404.

H. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Truss type with single pair of side rods.

1. Available Products:

a. Dayton Superior Corporation, Dur-O-Wal Division; Dur-O-Truss.

b. Hohmann & Barnard; Truss-Mesh, #120.
c. Wire-Bond; Series 300, Single Wythe.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

D. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

1. Available Products:

a. Hohmann and Barnard #PTA 420.
b. Heckman: No. 419, Pin type.
c. Wire Bond: Partition Top Anchor.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:

a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.

    a. Anchor Section: Zinc-alloy barrel section with adjustable flanged head with eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
    b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.
    c. Product:

        1) Hohmann & Barnard, Inc.: 2-Seal™ Tie (Wing Nut).

2.8 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

B. Postinstalled Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Drip Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, as follows:

1. Metal Drip Edges: Fabricate from 26 gage stainless steel. Extend at least 4-1/2 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and back edge turned up 1-1/2 inch.
2. Available Product: No. 1008 by Heckman Building Products Inc.

B. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch.

    a. Products: Subject to compliance with requirements, provide one of the following:

        1) Advanced Building Products Inc.; Strip-N-Flash.
        2) Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.

3) Grace Construction Products, W. R. Grace & Co. - Conn.; Perm-A-Barrier Wall Flashing.
4) Heckmann Building Products Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
5) Hohmann & Barnard, Inc.; Textroflash.
6) W. R. Meadows, Inc.; Air-Shield Thru-Wall Flashing.
7) Polyguard Products, Inc.; Polyguard 400.
8) Sandell Manufacturing Co., Inc.; Sando-Seal.

b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

1) Termination Seal: Bituthene® Liquid Membrane or equal by others.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
2. Where flashing is fully concealed, use flexible flashing.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Holmann & Barnard: #NS – Closed Cell Neoprene.
b. Sandell: Closed Cell Neoprene.
c. Wire Bond: 3000 Horizontal.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weep/Vent Products: Use the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

a. Available Products:

1) Advanced Building Products Inc.; Mortar Maze weep vent.
2) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.

3) Heckmann Building Products Inc.; No. 85 Cell Vent.
4) Hohmann & Barnard, Inc.; Quadro-Vent.
5) Sandell: Cell Vent.
6) Wire-Bond; Cell Vent.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Thickness as cavity will allow.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Advanced Building Products Inc.; Mortar Break.
b. Mortar Net USA, Ltd.; Mortar Net.

F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.11 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin.

1. Available Products: Provide the following or approved substitute.

a. Dow Chemical Company; Sytrofoam Square Edge.

1) Provide for gypsum sheathing walls.
2) Provide 4 by 8 foot sheets with square edges, thickness as indicated on the drawings.

B. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.12 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate (Spic and Span) and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Manufacturers:

a. 202V Vana-Stop; Diedrich Technologies, Inc.
b. Sure Klean Vana Trol; ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide type S mortar for all applications stated unless another type is indicated.

1. Use mortar mix where grout is indicated for brickwork.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Face brick.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that foundations are within tolerances specified.
2. Verify that reinforcing dowels are properly placed.
3. Verify that built-in items are in proper location and ready for roughing into masonry work.
4. Examine wall framing and sheathing to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.
2. In addition to ASTM C90 requirements for defects in CMU units, do not install interior CMU units with defects larger than 1/4 inch, and defects visible from 5 feet away.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Bracing Walls During Construction: It is the sole responsibility of the masonry contractor to design and provide temporary bracing of masonry walls during construction. Refer to NCMA Tek Bulletin 3-4B and applicable OSHA standards. Provide 3' vinyl construction fencing around Restricted Zones.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Where cutting and patching of existing masonry walls, tooth in new work where finished product will be exposed to view.

F. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

G. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

H. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

I. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units or brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints to match existing (weather struck) when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is necessary, remove mortar and replace.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Apply air barrier to face of backup wythe to comply with Section 072713 "Modified Bituminous Sheet Air Barriers."

D. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with foam insulation specified in Division 07 section "Thermal Insulation".

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

1. At "T" intersection of walls, Strap Anchors may be used in lieu of masonry joint reinforcement. Install 16 inches on center.

3.8 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through insulation, air/vapor barrier, and sheathing to wall framing with metal fasteners of type indicated.
2. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than 1 anchor for each 1.77 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.9 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Install control joints in veneer masonry as indicated on the drawings or, if not indicated, at a maximum spacing of 24 feet on center. Locate joints at door and window jambs inasmuch as possible.

1. Provide joints at both sides of windows and doors 6 foot wide or wider.

A. Form control joints in concrete masonry as follows:

1. Install preformed control-joint gaskets designed to fit standard sash block.
2. Joint reinforcement shall be discontinuous at control joints.
3. Structural bond beam reinforcement shall be continuous through control joints.

B. Form expansion joints in brick made from clay or shale as follows:

1. Build in compressible joint fillers and set back from face of veneer to form open joint 3/4 inch deep and not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."

3.10 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Install metal drip flashing on top of masonry unit.
2. At lintels and shelf angles, extend metal drip flashing a minimum of 8 inches into masonry at each end. At heads and sills, extend metal drip flashing 8 inches at ends and turn up not less than 2 inches to form end dams.
3. Adhere flexible flashing to vertical leg of metal drip flashing.
4. Extend flexible flashing across thickness of insulation, turned up a minimum of 8 inches and adhering to air barrier membrane. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, flexible flashing strip.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.
3. Provide weep holes not more than 8 inches from end of lintels.

D. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

E. Install vents in vertical head joints at the top of each continuous cavity. Use specified weep/vent product to form vents.

1. Space vents 24 inches o.c.

3.12 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

C. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

D. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.14 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning for CMU: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry with job-mixed detergent solution by cleaning method indicated in NCMA TEK 8-2A and as applicable to type of stain on exposed surfaces.

E. Final Cleaning for Brick Veneer: After mortar is thoroughly set and cured for a minimum of 7 days, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Protect metal roof and/or floor deck from contact with cleaner by covering with polyethylene film. Should damage occur to metal deck, repair damaged deck finish by re-priming steel deck materials or applying a ZRC coating to galvanized deck materials.
5. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water. Do not use pressure sprayers, garden hose type and pressure only.
6. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20 Revised, and manufacturer's printed instructions.

3.15 MASONRY WASTE DISPOSAL

A. Excess Masonry Waste: Remove excess clean masonry waste and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 047200 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast stone veneer.

B. Related Sections:

1. Section 034500 "Precast Architectural Concrete."
2. Section 042000 "Unit Masonry" for installing cast stone units in unit masonry.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Selection:

1. For each color and texture of cast stone required, 10 inches square in size.
2. For colored mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicated types and amounts of pigments used.

D. Full-Size Samples for Verification: For each color and texture of cast stone unit required.

1. Make Samples from materials to be used for units used on Project immediately before beginning production of units for Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.

1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute, the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

2.2 CAST STONE UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Continental Cast Stone; Designer Collection – Select Stone, Smooth.

B. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure units as follows:

1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than six days at mean daily temperature of 60 deg F or above.
c. No fewer than seven days at mean daily temperature of 50 deg F or above.
d. No fewer than eight days at mean daily temperature of 45 deg F or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Color and Texture: Provide units with fine-grained texture and buff color resembling concrete.

2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 042000 "Unit Masonry."

2.4 ACCESSORIES

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast

stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Diedrich Technologies, Inc.
    b. EaCo Chem, Inc.
    c. ProSoCo, Inc.

2.5 MORTAR MIXES

A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Install cast stone units to comply with requirements in Section 042000 "Unit Masonry."

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Hoist beam and its accessories for the elevator is provided under this section.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and described below in this Section.
2. Provide engineering analysis using ASD.

1.5 ACTION SUBMITTALS

A. Submit one hard copy and one electronic copy (PDF format) of all action submittals required by this Section at full-size and full-scale. See Division 1 for additional submittal requirements.

B. Product Data: For each type of product indicated.

C. Submittal packages shall be complete and include all Erection Drawings, all framing levels and all pieces, such as column, beam and braces. Submittal shall not be partial packages; for example just columns, just beams, etc.

1. To expedite the review process, submit an early package of just Erection drawings showing complete size and layout of all pieces, and details of all field work required by the Erector to resolve any supplementary information before piece drawings are generated. Only upon

acceptance of all layouts, including size and location of all framing at openings, shall piece drawings be submitted for review.

2. Shop Fabrication Drawings: Show fabrication of structural-steel components.
   a. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   b. Include an early, separate embedment drawing package.
   c. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show all welds in all locations – do not mark as typical.
   d. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   e. For structural-steel connections, follow all typical details and sections shown on the Drawings to the greatest extent possible. Details shown on any Drawing are to be considered typical for all similar conditions, unless noted otherwise.
   f. For simple shear beam-beam or beam-column connections, provide the following connections types to the greatest extent possible and per the typical schematic details on the Drawings:
      1) At all square conditions, provide the scheduled rows of bolts for the depth of the beam at a 3" pitch in a standard double angle framed connection; supporting calculations are not required when complying with the Schedule. Single angle connections are unacceptable.
      2) At all other conditions (including but not limited to skewed connections), provide shear tabs with supporting calculations indicating compliance with the shear loads specified on the Drawings.
      3) At HSS connections, the design intent is to achieve concealed connections using temporary field erection bolts to be removed after field welding the permanent connection; provide clips or tabs for erection to be removed after field welding. See schematic details on the Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, or who can demonstrate successful experience on three other projects of comparable size in the past 5 years.

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, or who can demonstrate successful experience on three other projects of comparable size in the past 5 years.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."

6. RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.9 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A490, Type 1, heavy hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type, plain.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852 (or A325) Type 1 with round head steel structural bolts with splined ends; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

D. Anchor Rods: ASTM F 1554, Grade 36 or ASTM A 36/A 36M.

1. Configuration: As detailed on the Drawings.
2. Nuts: ASTM A 563 hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 hardened carbon steel.
5. Finish: Plain.

E. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 hex carbon steel.
2. Washers: ASTM A 36/A 36M carbon steel.
3. Finish: Plain.

F. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

2.3 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors and Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer. Use automatic end welding according to AWS D1.1 and manufacturer's written instructions.

F. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.4 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints" using ASTM F1852, A325 or A490 Bolts for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.5 SHOP SURFACE PREPARATION AND PRIMER

A. Shop primer not required; steel to primarily receive field applied, sprayed fire-resistive materials. Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

B. For steel scheduled to receive intumescent mastic fireproofing in the field, provide the following. Refer to the Architectural Drawings for the extents of Exposed Structural Steel and required Shop Priming.
1. Surface Preparation: Clean surfaces to be primed. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
a. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning." (95 percent of surface area shall be free of visible residue)
2. Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils for each coat; obtain a total thickness of 3.0 mils.
a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
b. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanized lintels attached to structural-steel frame.
3. All other structural steel members specified to be galvanized on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

D. Splice members only where indicated.

E. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors and Deformed Bar Anchors: Prepare steel surfaces as recommended by manufacturer. Use automatic end welding according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.

a. Grind butt welds flush.
b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Steel Construction is subject to the IBC's Chapter 17 requirements for "Structural Tests and Special Inspections." Contractor shall fully cooperate with timely scheduling and accessibility for these required tests and inspections. See Structural Drawing S0.02 for a Program and Schedule of all required tests and inspections.
1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
3. A third inspection of Work failing to comply with specified requirements shall be done at Contractor's expense.
4. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Provide lifts as needed to perform inspections.
5. Contractor shall schedule testing and inspections and 48 hours in advance of scheduled concrete delivery.
6. Contractor shall not place any concrete encasing metal deck, shear studs, column base plates, or any other structural item until an Inspection has been made and the Work to be encased has been formally accepted.

B. Work will be subject to the following inspections, including but not limited to:
   1. Bolted Connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
   2. Welded Connections will be visually inspected according to AWS D1.1.
      a. Lateral force resisting beam to column moment connection field welds will be tested according to AWS D1.1 and Ultrasonic Inspection, ASTM E 164.
   3. In addition to visual inspection, field-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
      a. Bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
      b. Tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.
3. All deck accessories as specified herein and as detailed on the Drawings.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.

1.3 ACTION SUBMITTALS

A. Submit one hard copy and one electronic copy (PDF format) of all submittals required by this Section at full-size and full-scale. See Division 1 for additional submittal requirements.

B. Product Data: For each type of deck, accessory, and product indicated.

C. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.
2. Acoustical roof deck.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.

2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0747 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

J. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by Hilti Pin X-ENP-19L15, and as follows:
1. Fastener Spacing: 36/7 pattern for 6” rib spacing or 24/4 pattern for 8” rib spacing and at 6”o/c on deck edge at the building perimeter and all interior opening edges.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

1. Mechanically fasten plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8 inch nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
3. Weld Spacing: Space and locate welds as indicated.
4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Steel Construction is subject to the IBC's Chapter 17 requirements for "Structural Tests and Special Inspections." Contractor shall fully cooperate with timely scheduling and accessibility for these required tests and inspections. See Structural Drawing S0.02 for a Program and Schedule of all required tests and inspections. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
3. A third inspection of Work failing to comply with specified requirements shall be done at Contractor's expense.
4. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Provide lifts as needed to perform inspections.
5. Contractor shall schedule testing and inspections and 48 hours in advance of scheduled concrete delivery.

6. Contractor shall not place any concrete encasing metal deck, shear studs, column base plates, or any other structural item until an Inspection has been made and the Work to be encased has been formally accepted.

B. Work will be subject to the following inspections, including but not limited to:
   1. Side-lap fastener size and spacing.
   2. Welded Connections will be visually inspected according to AWS D1.1.

C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior Wall, parapet and fascia framing.
2. Exterior Ceiling and/or exterior soffit joist framing.
3. Platform floor overbuilds.
4. Refer to Structural Drawings for typical anchorage and load path requirements to the primary structure, as well as any special framing conditions.

B. Related Sections include the following:
1. Division 08 Section “Glazed Aluminum Curtain Wall” for special loads imparted by Sun Control Devices.
2. Division 09 Section "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated. Provide minimum depths, gages, flange widths and spacings at salient building corners as required in this Specification or on the Drawings, regardless of design computations.

1. Design Loads: Per Chapter 16 of the 2009 IBC and ASCE 7-05. See Structural General Notes for all required design data, including but not limited to floor live loads, exposure, thermal and importance factors. Also coordinate and design for special loads imparted by Aluminum Curtain Wall and Sun Control Devices.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Wall Framing: Horizontal deflection of 1/600 of the wall height where backing up Brick Veneer (where the Brick Veneer height is greater than half the wall height), otherwise L/360.
b. Exterior Ceiling / Soffit Joist Framing: Vertical deflection of 1/360 of the span.

3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 3/4 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 ACTION SUBMITTALS

A. Submit one hard copy and one electronic copy (PDF format) of all submittals required by this Section at full-size and full-scale. See Division 1 for additional submittal requirements.

B. Product Data: For each type of cold-formed metal framing product and accessory indicated.

C. Shop Drawings: Show complete layout of studs, jambs and headers for all exterior walls on 1/8” = 1’-0” scale Wall Framing Elevations in their entirety, including but not limited to spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work. Shop drawing submittals without entire wall framing elevations are unacceptable and will not be reviewed. Architect's review includes but is not limited to suitability of the submittal for construction, inspection and as an Owner's record.

1. For cold-formed metal framing indicated to comply with design loads, submit structural analysis calculations signed and sealed by the qualified professional engineer responsible for their preparation. The Engineer shall also sign and seal each shop drawing. Review of structural analysis calculations is for general conformance with requirements, completeness and assumed load path back to the primary structure. The responsibility for correctness rests solely with the design professional. The Architect reserves the authority to require resubmittal for observed deficiencies, or incompleteness. Calculations and Shop Drawings must be submitted together in the same submittal package for concurrent review.

2. Nomenclature: Use Steel Stud Manufacturer Association (SSMA) four part identification code which identifies the size (both depth and flange width), style and material thickness of each member. Shop drawings without this nomenclature are unacceptable and will not be reviewed.

D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.

4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research/Evaluation Reports: For cold-formed metal framing.

F. Special Inspection Field Reports: The professional engineer responsible for the design shall schedule at least FIVE site visits and submit inspection field reports bearing his/her seal, including a final affidavit after the construction is complete and inspected stating that the Work is complete and is in accordance with all requirements.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a professional engineer licensed in the State of Maine.

B. Professional Engineer Qualifications: A professional engineer who is licensed to practice in the State of Maine and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.
21. Approved equal, with an ICC report submittal.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G60, A60, AZ50, or GF30.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 minimum.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.054 inch.
2. Minimum Flange Width: 2.0 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 2.0 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dietrich Metal Framing; a Worthington Industries Company.
b. MarinoWare, a division of Ware Industries.
c. SCAFCO Corporation
d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 2.0 inches.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 CEILING / EXTERIOR SOFFIT JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 2.0 inches, minimum.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide Resilient Furring Channels similar to RC Deluxe by Dietrich, RCSD 25 gauge.

C. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 or ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are detailed for track or tension members. In nested, built-up jambs taller than 10’-0”, track sections shall be neglected in the calculation for strength and stiffness.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to track, unless otherwise indicated. Space studs as follows regardless of design computations:

1. Stud Spacing: 16 inches maximum, except 12 inches maximum within salient building corners ("a" distance per Figure 6-3 of ASCE 7-05) and at “Applied Tech Lab” room.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at centers indicated on Shop Drawings.

2. Bridging: At Contractor’s option:
a. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
b. Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
c. Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

G. Install horizontal support of safing insulation where indicated at exterior wall framing. Provide stud-track solid blocking of width and thickness to match studs.

3.5 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor’s design engineer shall include special inspection services to perform field inspections and prepare test reports. Contractor shall fully cooperate with timely scheduling and accessibility for these required tests and inspections.
1. Payment for these services shall be included in the Contractor’s base bid.
2. A minimum of FIVE site visits are required.
3. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
4. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Provide lifts as needed to perform inspections.

5. Contractor shall schedule testing and inspections 48 hours in advance of installing any sheathing.
6. Contractor shall not conceal any structural item until an Inspection has been made and the Work to be encased has been formally accepted.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors and grilles.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Elevator machine beams, hoist beams,.
7. Steel shapes for supporting elevator door sills.
8. Metal ladders.
9. Elevator pit sump covers.
10. Metal bollards.
11. Abrasive metal nosings.
12. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 051200 "Structural Steel Framing."
4. Section 129300 "Site Furnishings" for bicycle racks.
5. Section 329300 "Plants" for tree grates.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type and finish of extruded nosing and tread.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

1. Provide ladders meeting the OSHA requirements of 29CFR 1910.27.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

F. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

1. Available Products:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
b. ICI Devoe Coatings; Catha-Coat 313.
c. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
d. PPG Architectural Finishes, Inc.; Epoxy Zinc Rich Primer 97-670.
e. Sherwin-Williams Company (The); Zinc Clad IV, B69A8/B69V8.
f. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

1. Available Products:

a. Sealmastic, Type 1; W. R. Meadows
b. Hydrocide 600; Sonneborn Building Products.
c. Karnak 100 AF; Karnac Chemical Corp.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports.

F. Provide stainless steel support angles in masonry veneer cavity walls when located within 36 inches from exterior finished grade.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Fabricate ladders from materials as detailed on the drawings or if not indicated, as follows:

1. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches .
2. Rungs: 3/4-inch- diameter steel bars, spaced 12 inches .
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Available Products:

    a. IKG Industries, a Harsco company; Mebac.
    b. W. S. Molnar Company; SlipNOT.

7. Galvanize exterior ladders, including brackets.
8. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

2.8 ELEVATOR PIT SUMP COVERS

A. Frame: Provide 1-1/2 by 1-1/2 by 1/4 inch steel angle around perimeter of sump pit, fastened with 1/4 inch galvanized expansion anchors. Hold back the perimeter angle 3 inches from each of the four corners.

B. Cover: Provide a 1/4 inch thick steel cover plate with each of the four corners cut back 3 inches on an angle to provide drainage holes in each of the four corners.

2.9 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

C. Galvanize exterior steel frames.

D. Prime interior steel frames with zinc-rich primer.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

B. Prime bollards with zinc-rich primer.

2.11 ABRASIVE METAL NOSINGS

A. Cast-Metal Units: Cast aluminum, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

B. Configurations: Provide units in configurations indicated by model numbers.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

1. Available Products:

a. American Safety Tread Co., Inc.: Style 801.
b. Balco/Metalines, Inc.: CA-200 with type 8 wing anchor.
c. Safe-T-Metal Co.: Style AX with loose steel anchor.
d. Wooster Products Inc.: Type 101 with stainless steel wing anchor.

2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.13 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in interior walls with zinc-rich primer.

2.14 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.15 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES

A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dipped process, Durogalv by Duncan Galvanizing. The galvanizing bath shall contain high grade zinc and other earthly materials. Immediately before galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The use of the wet kettle process is prohibited. Comply with ASTM A123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions, overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with gravel backfill. Place backfill and vibrate or tamp for consolidation. Support and brace bollards in position.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.4 INSTALLING NOSINGS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

3.5 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 055000 "Metal Fabrications" for metal nosings installed at locations other than in metal stairs.
3. Section 055213 "Pipe and Tube Railings" for pipe and tube railings not attached to metal stairs or to walls adjacent to metal stairs.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Uniform Load: 100 lbf/sq. ft..
2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
3. Uniform and concentrated loads need not be assumed to act concurrently.
4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.

c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor is 1.5.

1.4 ACTION SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Field Reports: The professional engineer responsible for the design shall schedule at least THREE site visits and submit inspection field reports bearing his/her seal, including a final affidavit after the construction is complete and inspected stating that the Work is complete and is in accordance with all requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1. Preassembled Stairs: Commercial class.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

D. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts.

D. Machine Screws: ASME B18.6.3.

E. Lag Screws: ASME B18.2.1.

F. Plain Washers: Round, ASME B18.22.1.

G. Lock Washers: Helical, spring type, ASME B18.21.1.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

F. Welded Wire Fabric: ASTM A 185/A 185M, 6 by 6 inches, W1.4 by W1.4, unless otherwise indicated.

2.5 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld connections to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Weld exposed corners and seams continuously unless otherwise indicated.
5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.6 STEEL-FRAMED STAIRS

A. Stair Framing:

1. Fabricate stringers of steel channels.

a. Provide closures for exposed ends of channel stringers.

2. Construct platforms of steel channel headers and miscellaneous framing members as indicated.
3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 STAIR RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Configuration: As indicated on the drawings.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes okay.

C. Form changes in direction of railings as follows:

1. As detailed.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect posts to stair framing by direct welding unless otherwise indicated.
2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal stairs after assembly.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:

1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.2 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Use type of bracket with predrilled hole for exposed bolt anchorage. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall

surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055100

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.
2. Aluminum pipe and tube railings.
3. Stainless-steel pipe and tube railings.

B. Related Requirements:

1. Section 055100 "Metal Stairs" for steel tube railings associated with metal stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. Evaluation Reports: For post-installed anchors , from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON (for typical interior wall rails **and guardrails**)

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Woven-Wire Mesh: Provide the different patterns where indicated on the drawings:

1. Square pattern, 1-inch woven-wire mesh, made from 11 gage nominal diameter wire complying with ASTM A 510.
2. Square pattern, 2-inch woven-wire mesh, made from 11 gage nominal diameter wire complying with ASTM A 510.
3. Square pattern, 3-inch woven-wire mesh, made from 0.192-inch nominal diameter wire complying with ASTM A 510.

E. Wire Rope and Fittings:

1. Wire Rope: 3/16 inch diameter, 7-by-7 galvanized wire rope.

2. Wire-Rope Fittings: Connectors of types indicated, fabricated from galvanized steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.4 ALUMINUM (for exterior railings)

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

C. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

D. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

E. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

F. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL (for wall rails at S.E. Lobby)

A. Tubing: ASTM A 554, Grade MT 304.

B. Pipe: ASTM A 312/A 312M, Grade TP 304.

C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20.

D. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

2.6 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Aluminum Railings: Type 304 stainless-steel fasteners.
3. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
4. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where **Aluminum** Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum and stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.8 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

E. Form work true to line and level with accurate angles and surfaces.

F. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

G. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

H. Connections: Fabricate railings with welded connections unless otherwise indicated.

I. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

J. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

K. Form Changes in Direction as Follows:

1. As detailed.

L. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

M. Close exposed ends of railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

Q. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

R. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

S. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into 1-by-1/2-by-1/8-inch metal channel frames.

1. Make wire mesh and frames from same material as guardrail.
2. Orient wire mesh with wires horizontal and vertical, unless otherwise indicated.

2.9 STEEL AND IRON FINISHES

A. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with universal shop primer unless indicated.
2. Do not apply primer to galvanized surfaces.

2.10 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Mill Finish: AA-M12, nonspecular as fabricated.

2.11 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines, or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Directional Satin Finish: No. 4.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

A. Attach railings to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

3.7 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, furring and nailers.
3. Miscellaneous sheathing.
4. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing."

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NHLA: National Hardwood Lumber Association.
3. NLGA: National Lumber Grades Authority.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

A. Maximum Moisture Content of Lumber: Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Concealed blocking.
2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 MISCELLANEOUS SHEATHING

A. Plywood Wall Sheathing: Exposure 1, Structural I (CDX) sheathing.

1. Span Rating: Not less than 24/0 or 32/16.
2. Nominal Thickness: As indicated on the drawings.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

E. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual".

2.2 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corporation; GlasRoc.
b. G-P Gypsum Corporation; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond e(2)XP.
d. United States Gypsum Co.; Securock.

2. Type and Thickness: Type X, 5/8 inch thick.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Plastic-laminate cabinets.
3. Wood veneer cabinets.
4. Wood countertops.
5. Plastic-laminate countertops.
6. Solid-surfacing-material countertops.
7. Solid-surfacing-material window sills.
8. Shop finishing of interior woodwork.
9. Open wall shelving.

1.3 SUBMITTALS

A. Product Data: For panel products high-pressure decorative laminate adhesive for bonding plastic laminate solid-surfacing material cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets and other items installed in architectural woodwork.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. PVC edge material.
3. Thermoset decorative panels.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 50 sq. in., for each species and cut, finished on 1 side and 1 edge.

2. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish.

3. Exposed cabinet hardware and accessories, one unit for each type and finish.

E. Keying Schedule: Prepare Owner's final keying instructions for locks. Include schematic keying diagram.

1.4 QUALITY ASSURANCE

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with such selections and requirements in addition to the quality standard.

C. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish (Stain or clear finish):
1. Species and Grade: White maple; Clear; NHLA, Quarter sawn.
2. Finger Jointing: Not allowed.
3. Gluing for Width: Allowed.
4. Face Surface: Surfaced (smooth).
5. Matching: Selected for compatible grain and color.

C. Wood Products: Comply with the following:

1. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
2. Particleboard: ANSI A208.1, Grade M2.

D. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1**,** made with adhesive containing no urea formaldehyde.

E. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Colors: Provide full color options available from Panolam or Panval not just standard white, putty, almond, and grey.
2. Provide PVC edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Basis of design: Subject to compliance with requirements, provide high-pressure decorative laminate:
a. **PLAM-1** Lamin-Art, Inc.#3051-VT Natural Teak Velva-Tex.
b. **PLAM-2** Lamin-Art, Inc. #2407-T Taupe with Oyster Shield.

2.2 SOLID-SURFACE-MATERIAL COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.

3. Endsplash: Matching backsplash.

B. Countertops: 3/4-inch- thick, solid surface material with front edge built up with same material.

C. Backsplashes: 3/4-inch- thick, solid surface material.

D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. E. I. du Pont de Nemours and Company (Corian).

2. Type: Standard type, unless Special Purpose type is indicated.
a. Colors and Patterns:
1) SSURFACE-1: Sorrel
2) SSURFACE-2: Color TBD

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.

1. Available Products:

a. Blum: BH75T1550.
b. Grass: GHA3703M.
c. MEPLA: CS04 (MH146304550015).

C. Catches: Magnetic catches, BHMA A156.9, B03141

D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

E. Adjustable Shelf Standards and Supports:

1. Available Products: Knape & Vogt Mfg. Co.: No. 82 heavy-duty brackets, No. 182 Standards, color as selected by the Architect.

F. Cabinet Shelf Rests: Knape & Vogt Mfg. Co.: No 255 Pilaster and support clips, zinc finish

G. Drawer Slides: BHMA A156.9, B05091; Heavy Duty (Grade 1HD-100): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

1. Available Products:
   a. Accuride 9301.
   b. KV 8417.

H. Drawer and Door Locks: Provide Locks by Olympus Lock, Inc.; 100 DR door lock and 200 DW drawer lock. No substitutions.

1. Provide 6 master keys with all locks keyed alike.
2. Provide on drawers and doors where indicated.
3. Provide epoxy adhesive to retain lock attachments in place.

I. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc.
2. Color: As selected by Architect from manufacturer's full range.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel: BHMA 630.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Contact Adhesive: 250 g/L.

E. Adhesive for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species and Cut: White maple, quarter sawn.

C. For trim items wider than available lumber, use veneered construction. Do not glue for width.

D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

F. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

2.7 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Full overlay on face frame.

C. Wood Species and Cut for Exposed Surfaces: White maple, quarter sawn.

1. Grain Direction: Horizontally for drawer fronts. Vertically for doors and fixed panels.
2. Matching of Veneer Leaves: Book match.
3. Vertical Matching of Veneer Leaves: End match.
4. Veneer Matching within Panel Face: Center-balance match.
5. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

D. Semiexposed Surfaces: Provide maple veneer plywood surface materials and/or as indicated below:

E. Component Materials:

1. Body Members: Ends, bottom, divisions, rails and tops: 3/4 inch pre-finished maple plywood panels with clear finish, all exposed and semi-exposed sides. Provide Type B or C flush joint for underside of wall cabinets as required by AWI 400-G-7.
2. Shelves: 3/4 inch thick panels. Provide 1 inch thick where shelf widths are required to meet AWI 400-G-8.
3. Backs: 3/8 inch thick pre-finished maple plywood panels.
4. Drawer sides, backs: 1/2" panels or solid lumber.
5. Drawer Bottoms: 1/4" pre-finished maple plywood panels.
6. Drawer Fronts: 3/4 inch pre-finished maple plywood panels with 1/8” maple edge band at all sides. Run grain vertically.
7. Cabinet Doors: 3/4 inch pre-finished maple plywood panels with 1/8” maple edge band at all sides. Run grain vertically.
8. Edging: 1/8 inch thick maple wood edge at all exposed and semi-exposed edges.
9. Base Toe Kick: 3/4" plywood.

2.8 PLASTIC-LAMINATE CABINETS

A. Grade: Custom, unless noted otherwise.

B. AWI Type of Cabinet Construction: Flush overlay without face frame.

C. Component Materials:

1. Body members - ends, bottom, divisions, rails and tops: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging, all exposed and semi-exposed sides. Provide Type B or C flush joint for underside of wall cabinets as required by AWI 400-G-7.
2. Shelves: Minimum 3/4 inch thick particleboard, Thermoset Decorative Overlay (melamine) each side with 3 mm PVC edging. Provide material and thickness required to meet AWI 400-G-8.
3. Backs: 1/4 inch thick particleboard, Thermoset Decorative Overlay (melamine) each side.
4. Drawer sides, backs and subfronts: 1/2" hardwood plywood or solid lumber.
5. Drawer Bottoms: 1/4" hardwood plywood.

6. Drawer Fronts: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging.
7. Premanufactured drawer systems: Drawer systems will be acceptable similar to Blum Metabox C-15 or approved equal.
8. Cabinet Doors: .028" exterior laminate over 3/4 inch thick particleboard, interior Thermoset Decorative Overlay (melamine) with 3 mm PVC edging.
9. Edging: Band all exposed edges with 3 mm PVC.
10. Base Toe Kick: Hardwood plywood.

D. Colors, Patterns, and Finishes:
   a. **PLAM-1** Lamin-Art, Inc.#3051-VT Natural Teak Velva-Tex.

2.9 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Premium.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range in the following categories:

   a. Solid colors, matte finish.
   b. Patterns, matte finish.

D. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: As indicated.

F. Core Material: Particleboard.

G. Core Material at Sinks: Particleboard made with exterior glue.

H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

I. Colors, Patterns, and Finishes:
   a. **PLAM-2** Lamin-Art, Inc. #2407-T Taupe with Oyster Shield.

2.10 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 3/4 inch.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with loose backsplashes for field application.

E. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

2.11 SOLID-SURFACING-MATERIAL WINDOW SILLS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 3/4 inch.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. As selected by Architect from manufacturer's full range.

D. Fabricate sills in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

2.12 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

D. Transparent Finish:

1. Grade: Custom.
2. AWI Finish System TR-5: Catalyzed vinyl.
3. Staining: As selected by Architect.
4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
5. Sheen: Satin, 30-50 gloss units.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.

1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

I. Window Sills: Anchor securely by adhering to substrate.

1. Install window sills with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Calk space between sill and window frame or walls with sealant specified in Division 07 Section "Joint Sealants."

J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Marlite.

2. Product: Marlite FR Class 1/A.

3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

4. Nominal Thickness: Not less than 0.09 inch.
5. Surface Finish: Molded pebble texture.
6. Color: TBD.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

   1. Color: Match panel color.

B. Base Molding: Include Marlite rigid extruded PVC base molding with outside corners.

   1. Color: Black.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

   1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install trim accessories with staples.

C. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

D. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

E. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

Marlite®

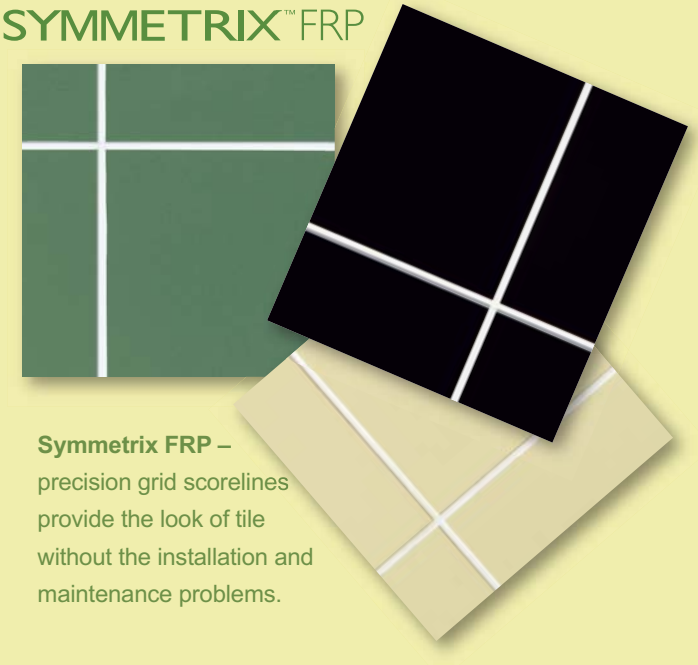
Designer Wall Systems

Innovative FRP Panels

Secondary Space Solutions. Second to none.

FRP

SYMMETRIX™ FRP



Symmetrix FRP – precision grid scorelines provide the look of tile without the installation and maintenance problems.

STANDARD FRP

Standard FRP – classic colors on smooth or pebble textured surfaces.

STANDARD FRP

Marlite Standard FRP Panels, available in textured and smooth surfaces provide ultimate durability in high wear spaces. Marlite FRP is tough, water-resistant, economical to install and easy to maintain.

Features

- Resists stains, chemicals, scratches and abrasions and possesses high impact strength.
- Is resistant to moisture, making the panel ideal for wet environments and does not support the growth of mold or mildew.
- Costs less installed than most other high impact product.
- Wipes clean easily with standard cleaning solutions.
- Meets USDA/FSIS requirements.
- Approved by Canadian Food Inspection Agency and Agriculture Canada.
- Available in Class III/C and Class I/A Fire-rating.
- Panel Dimensions – 4’ x 8’ x 3/32”, 4’ x 9’ x 3/32” (select finishes) and 4’ x 10’ x 3/32”.

STANDARD FRP

Dimensions

4' x 8' x 3/32",
4' x 10' x 3/32"
*Also available in
4' x 9' x 3/32".

Pebbled Surface

P 100 White *
P 100 White Class A *

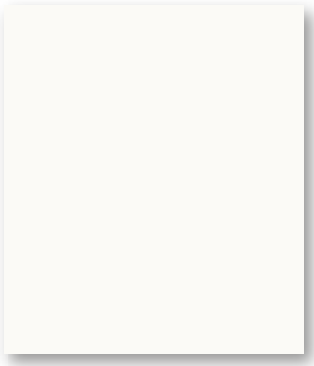
P 106 Beige
P 106 Beige Class A

Smooth Surface

S 100 S/2/S White

P 118 Natural Almond *
P 118 Nat. Almond Class A

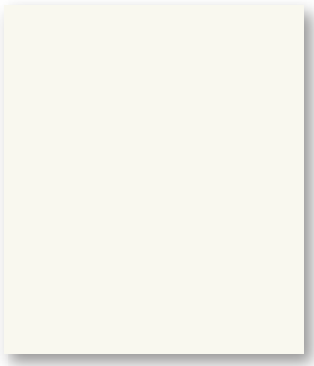
P 140 Ivory *
P 140 Ivory Class A



S 100G White

P 145 Silver *
P 145 Silver Class A

P 151 Light Grey *
P 151 Light Grey Class A



S 118G Almond

P 199 Bright White *
P 199 Bright White Class A

P 807 Black

FRP CEILING PANELS

*** FRP P100CP White**
Fire Rating:
Class C
Class A
Size:
2' x 4' x .090
2' x 2' x .090

*** FRP P100CP w/Gypsum**
Fire Rating:
Class A
Size:
2' x 4' x $^{23}/_{32}$*
.090 FRP Laminated to $^{5}/_{8}$" Fire Rated Gypsum

*Ceiling Grid System available upon request.

Simplified Installation

Artizan, Symmetrix and Standard FRP install easily and in a fraction of the installation time of ceramic tile. Symmetrix features scored grout lines, offering the same look as ceramic tile without the need for messy grout/sealer application.

FRP panels can be easily cut with shears or a carbide tip saw.

Simply apply Marlite Brand Adhesive to the back of FRP panels and apply them to the subwall.

Division Molding Installation

Adhere panel to subwall.

Slide Marlite Division Molding under edge of first panel.

Staple Division Molding to subwall along revealed edge.

Adhere second panel in place and repeat.

(Note: For wet environments, sealant is required in molding channels.)

Seam Joint Installation

Place a 6 penny spacing nail between panels.

Remove nail and protect panel face with tape. Wait one hour.

Place a bead of harmonizing Marlite Silicone Sealant in the gap.

Using your finger, place a slight indentation in the gap.

Remove the tape to reveal a grooved and matched seam joint.

Actual application requirements may vary, please call Marlite for complete installation instructions.

Accessories

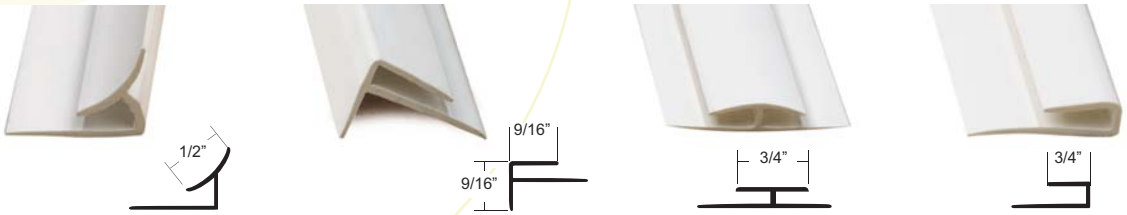
A Complete System

Artizan, Symmetrix and Standard FRP Panels are a part of a complete system, including PVC and Aluminum Trim and Base Molding, Outside Corner Guards, Adhesives and Silicone Sealants.

PVC Trim Molding

Color-integral PVC Trim Molding provides a professionally finished appearance and simplifies installation. Nailing/staple flanges make them easy to install. Typically used in conjunction with Symmetrix and Standard FRP.

Length: 8' and 10' **Material:** Extruded PVC with integral color.
Colors: Standard Marlite FRP colors - White, Beige, Natural Almond, Ivory, Silver, Light Grey, black.

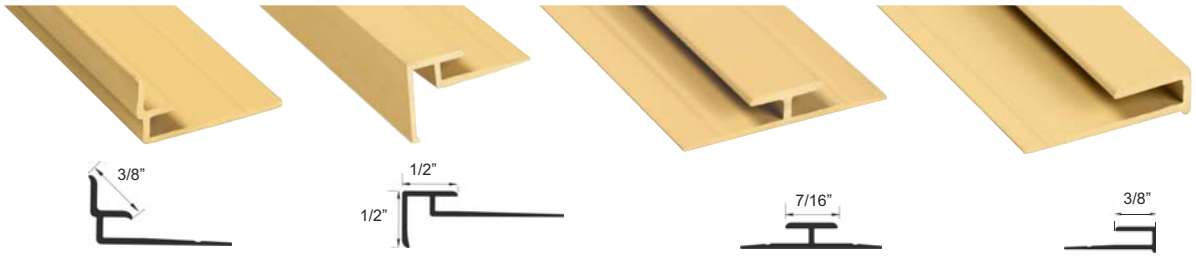


Inside Corner M350 | Outside Corner M360 | Division M365 | Edge M370

Harmonizing Aluminum Trim Molding

Durable painted Aluminum Molding harmonizes with any woodgrain or abstract Artizan FRP finish.

Length: 8' **Material:** Extruded Aluminum with durable finish.
Colors: As specified with Artizan FRP.

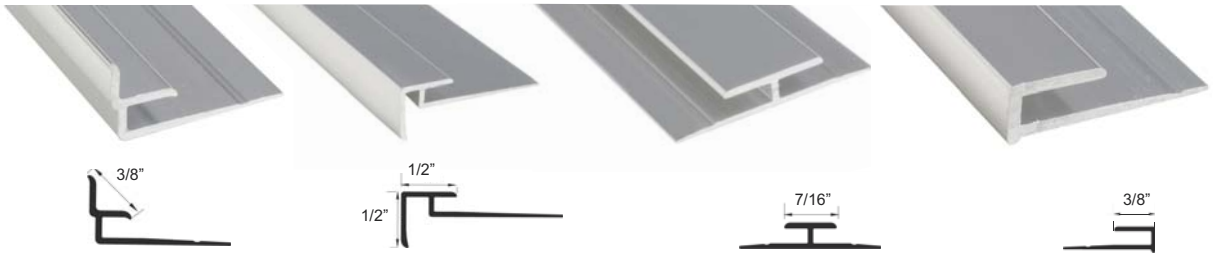


Inside Corner A551 | Outside Corner A560 | Division A565 | Edge A570

Bright Anodized FRP Molding

Durable painted Aluminum Molding harmonizes with any woodgrain or abstract Artizan FRP finish.

Length: 8' **Material:** Extruded Aluminum with durable finish.
Colors: As specified with Artizan FRP.



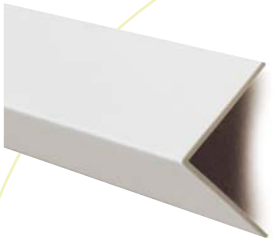
Inside Corner F550 | Outside Corner F561 | Division F565 | Edge F570

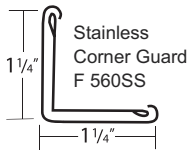
Outside Corner Guards

Outside Corner Guards provide added corner protection in high-traffic, high-abuse areas.

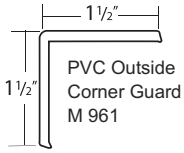
Length: 8’ and 10’
Material: Stainless Steel or Rigid Extruded PVC with integral color.
Colors: Most standard Marlite FRP colors - White, Natural Almond, Ivory*, Silver*, Light Grey*

* denotes 10’ length only





Stainless Corner Guard F 560SS



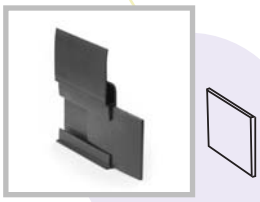
PVC Outside Corner Guard M 961

Base Molding

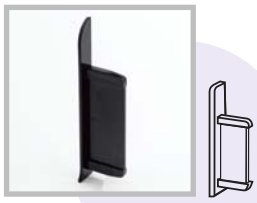
Patented-design Base Molding simplifies installation and helps totally seal the panel system.

Length: 4" wide x 10’ long
Material: Rigid extruded PVC with integral color.
Colors: P 200 Black, P 203 Quarry Red

FRP Base Molding M 612

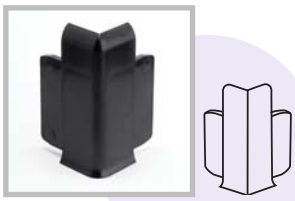


Butt Joint Connector Included with Base Molding strips

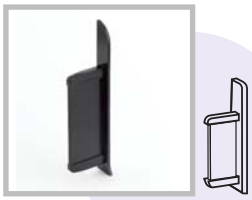


LH End Cap M 620

Inside Corner M 651



Outside Corner M 660



RH End Cap M 625

Adhesives & Sealants

Specially developed for use with Artizan, Symmetrix and Standard FRP when used on approved subwalls such as drywall and plywood. When used in conjunction with the complete line of accessories, these adhesives and sealants ensure the system’s ease of installation and performance.

C-551 Marlite FRP Adhesive
A high quality, low odor, non-flammable latex-based FRP adhesive for application over approved porous subwalls such as drywall or plywood. The adhesive meets low V.O.C. requirements. Size: 3.5 gallon can.

Trowel size: 3/16” W x 1/4” D x 1/2” C-C V-Notch

C-375 Marlite Construction Adhesive
A strong, flexible, moisture-resistant, all-purpose adhesive formulated for fast, easy application. This adhesive is an excellent choice for use over many non-porous surfaces. Synthetic rubber base remains pliable to compensate for movement of structural surface up to 1/8". Size: 3.5 gallon can.

MS-250 Clear, MS-251 White, & Color Matched Marlite Silicone Sealant
Waterproof silicone sealant for interior or exterior use. This sealant is extremely flexible and dries to a gasket-like finish. Size: 10-oz cartridge.

FRP Innovative FRP Panels

Surface Properties

All Artizan, Symmetrix and Standard FRP panels tested in accordance with the following specifications:

Abrasion: ASTM D 968-81

Adhesion: ASTM D 2197-91/ASTM D 3002

Cleanability/Stain Resistance: NEMA LD 3-2000 SEC. 3.4

Steam: NEMA LD 3-2000 SEC. 3.5

Physical Properties and Test Results

Property	ASTM Procedure	Typical Value				
		Marlite FRP	Marlite FR Class I/A	Symmetrix	Artizan Class C	Artizan Class A
Flexural Strengths (psi)	D790	1.7×10^4	1.0×10^4	1.6×10^4	1.3 x 104	1.2 x 104
Flexural Modulus (psi)	D790	6.0×10^5	3.1×10^5	1.0×10^6	3.1 x 105	6.5 x 105
Tensile Strengths (psi)	D638	8.0×10^3	7.0×10^3	7.5×10^3	1.1 x 104	6.5 x 103
Tensile Modulus (psi)	D638	9.43×10^3	1.6×10^6	1.7×10^6	4.7 x 105	5.1 x 105
Barcol Hardness	D2583	40	35	50	32	41
Izod Impact Strength (ft #/in)	D256	7.0	7.2	13	6.26.2	
Thermal Coefficient Of Lineal Expansion (in/in/F_i)	D696	1.57×10^{-5}	1.57×10^{-5}	1.39×10^{-5}	1.39×10^{-5}	1.39×10^{-5}
Water Absorption (%)	D570	.17	.72	.15	1.10	0.94
Specific Gravity	D792	1.53	1.80	1.80	1.80	1.80
Fire Ratings	E-84	Class III/C	Class I/A	Class III/C	Class III/C	Class 1/A
Flame Spread		<200	<25	<200	<200	<25
Smoke Generation		<450	<450	<450	<450	<450
CAN/ULC Fire Ratings	S102-M88					
Flame Spread		<90	<25			<20
Smoke Generation		<190	<450			<450
Mold Prevention	D6329-98	passed	passed	passed	passed	passed
Fungi Resistance	G21-96	passed	passed	passed	passed	passed

See Marlite's solutions for Feature Walls, Primary Spaces and Plank for Secondary Spaces. For specifications, technical details and installation instructions please visit us at **www.marlite.com**.

Marlite

Dover, Ohio 44622 • 800-377-1221 • www.marlite.com • info@marlite.com

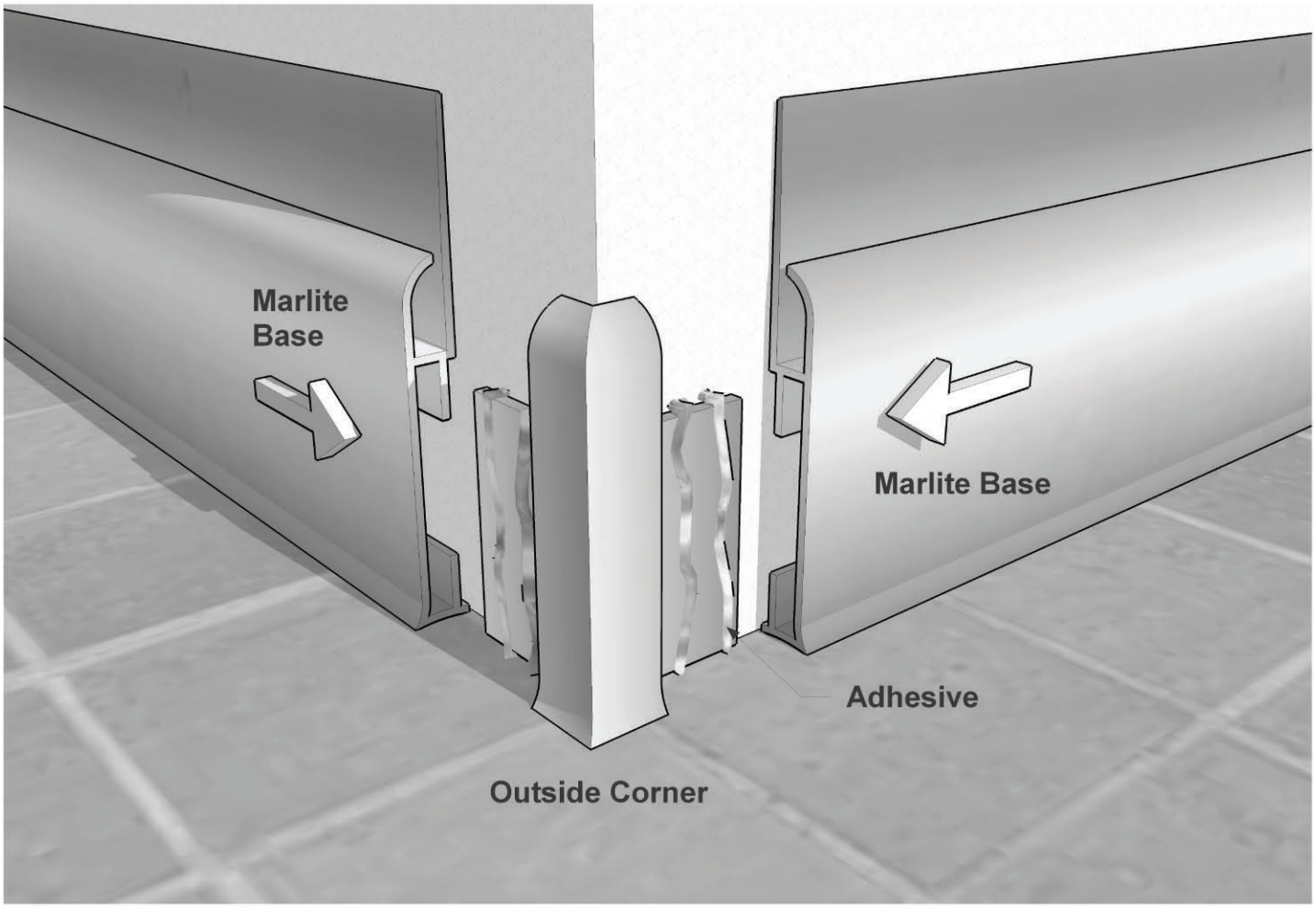
Form No. FR27-06111 Effective Date 06/09/11 Printed in U.S.A.

Features & Benefits for Marlite FRP Base Molding

Marlite FRP Base Molding offers a tough, durable solution for areas that require a sanitary application. The base is offered in Black and Quarry Red.

Key Benefits

- PVC material for durability
- One piece molded profile
- Complete system: end caps, inside corners, outside corners and butt joint connectors.



Marlite
www.marlite.com

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Blindside sheet waterproofing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

C. Samples: For each exposed product and for each color and texture specified, including the following products:

1. 8-by-8-inch square of waterproofing and flashing sheet.
2. 4-by-4-inch square of drainage panel.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Installer's Special Warranty: Specified form,signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
    b. Grace Construction Products; W.R. Grace & Co. -- Conn; Bituthene 3000/Low Temperature or Bituthene 4000.
    c. Henry Company; Blueskin WP 100/200.
    d. Meadows, W.R.,Inc; SealTight Mel-Rol.

2. Physical Properties:

    a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
    b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
    c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970.
    d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
    e. Puncture Resistance: 40 lbf minimum; ASTM E 154.
    f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
    g. Water Vapor Permeance: 0.05 perms maximum; ASTM E 96/E 96M, Water Method.
    h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 BLINDSIDE SHEET WATERPROOFING

A. Bonded HDPE or Polyethylene Sheet for Blindside Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane consisting of either an HDPE film coated with pressure-sensitive adhesive and protective release liner, total 46-mil thickness, or a cross-laminated film of low- and medium-density polyethylene, coated with a modified asphalt layer and a nonwoven geotextile-fabric final layer, total 95-mil thickness; with the following physical properties:

    1. Products: Subject to compliance with requirements, provide one of the following:

        a. Grace Construction Products; W.R. Grace & Co. -- Conn; Preprufe 300R.
        b. Polyguard Products, Inc; Underseal Underslab Membrane.

    2. Tensile Strength, Film: 2000 psi minimum; ASTM D 412.
    3. Low-Temperature Flexibility: Pass at minus 10 deg F; ASTM D 1970.
    4. Peel Adhesion to Concrete: 5 lbf/in. minimum; ASTM D 903, modified.
    5. Lap Adhesion: 2.5 lbf/in. minimum; ASTM D 1876, modified.
    6. Hydrostatic-Head Resistance: 231 feet; ASTM D 5385, modified.
    7. Puncture Resistance: 200 lbf minimum; ASTM E 154.
    8. Water Vapor Permeance: 0.01 perms maximum; ASTM E 96/E 96M, Water Method.
    9. Water Absorption: 0.5 percent maximum; ASTM D 570.

B. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.4 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft..

1. Products: Subject to compliance with requirements, provide one of the following:

a. American Hydrotech, Inc; Hydrodrain 400.
b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRAIN 6000.
c. Grace Construction Products; W.R. Grace & Co. -- Conn; Hydroduct 220.
d. Protecto Wrap Company; Protecto Drain 2000-V.

2.6 INSULATION

A. Insulation, General: Comply with Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.

2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.

D. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.

E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

F. Seal edges of sheet-waterproofing terminations with mastic.

G. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.

H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

3.4 BLINDSIDE SHEET-WATERPROOFING APPLICATION

A. Install bonded blindside sheet waterproofing according to manufacturer's written instructions.

B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.

C. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

D. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.

E. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.

F. Install sheet-waterproofing and auxiliary materials to produce a continuous watertight tie into adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.5 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install thermal board insulation before installing drainage panels.

3.6 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071326

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. **Spray polyurethane foam insulation.**

B. Related Sections:

1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls.
2. Division 07 Section "Thermoplastic Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.
3. Division 09 Section "Gypsum Board Shaft Wall Assemblies" for installation in metal-framed assemblies of insulation specified by referencing this Section.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Available Products:

a. Foamular 250; Owens Corning.
b. Styrofoam by Dow Chemical Co. (available from Conn. Plant)
c. Amofoam-CM by Tenneco Building Products

2. ~~60~~ **25** PSI strength rating.
3. R-Value: 5 per inch.
4. Application:

a. Subgrade rigid insulation applications.
b. Perimeter foundation insulation.
c. Rigid insulation below concrete slab-on-grade.

5. 60 PSI strength rating at subgrade locations.

2.2 SPRAYED FOAM INSULATION

A. Sprayed Polyurethane Foam Sealant for Perimeter of Doors and Windows: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

1. Products:

a. Great Stuff Window & Door by Dow
b. Froth-Pak by Insta-Foam Products, Inc.
c. Pur-Fill 1G by Todol Products, Inc.
d. Handi-Seal Window and Door Sealant by Fomo Products, Inc.

B. Foamed-in-Place Insulation: ASTM C 1029, Type II, two-component, spray-in-place, 1.8 to 2.0- lb-density, plastic foam with closed-cell structure, conforming to the following:

1. Flame/Smoke Properties: 25/450 in accordance with ASTM E84.
2. R-Value per Inch, Aged: 6.2 minimum.
3. Products:

a. Corbond® Performance Insulation System.
b. Henry Permax 1.8 Closed Cell Foam Insulation.
c. Styrofoam™ SPF Insulation.

2.3 PROTECTIVE COATINGS

A. Flame-Resistive Coating for Foamed-in-Place Insulation: Provide one of the following products approved by the Maine State Fire Marshall:

1. Cafco: TB-415.
2. Cafco: TB-15.
3. Flame Seal TB.
4. International Fireproof Technology, Inc.: DC315.
5. TPR2: Fireshell F10E.
6. TPR2: Fireshell F1E.

2.4 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units using manufacturer's recommended adhesive or loosely laid according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 60 inches below exterior grade line.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply foamed-in-place insulation, by spray or froth method to a uniform monolithic density without voids into miscellaneous voids and cavity spaces where shown.

1. At Locations Exposed To View: Apply Flame-Resistive Coating in accordance with manufacturer's recommendations.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072616 - BELOW-GRADE VAPOR RETARDERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Vapor retarders under slabs-on-grade.

1.3 DEFINITIONS

A. Vapor Retarder: Material with a water vapor transmission rating of not over 0.04g per square foot per hour.

B. Vapor Barrier: Material with a water vapor transmission rating of not over 0.015g per square foot per hour.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: 12 inch square units for each type of vapor retarder, vapor barrier, or air barrier indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers and Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following products listed in Part 2 of this Section.

2.2 VAPOR RETARDERS FOR UNDER SLABS

A. Vapor Retarder with extremely low permeance for critically sensitive, low permeance floor coverings such as rubber, vinyl, urethane, epoxy and methyl methacrylate, as well as linoleum and wood, having the following qualities:

1.	Minimum Permeance:	ASTM E-96, not greater than 0.01 perms.
2.	Tensile Strength:	ASTM E154 or D638, Class A – over 45 lbf/in.
3.	Puncture Resistance:	ASTM E-154, Class B – over 1700 grams.
4.	Water Vapor Barrier:	ASTM E-1745, meets or exceeds Class B.
5.	Thickness of Barrier (Plastic)	ACI 302.1R-96, not less than 15 mils.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Stego Wrap, 15 mil thick vapor retarder by Stego Industries LLC, (877) 464-7834.
2. Vaporguard by Reef Industries.
3. Sealtight Perminator 15 mil Underslab Vapor-Mat by W.R. Meadows, Inc.
4. Viper VaporCheck 16 by Insulation Solutions, Inc.

C. Vapor-Retarder Tape (for slabs): Stego Warp red polyethylene tape or tape as recommended by the manufacturer.

D. Double-Stick Edge Tape: Preformed 1-1/2" wide two-sided adhesive. Available products include “Fab Tape” by Reef Industries.

E. Expansion Joint Filler: Installer may elect to use Deck-O-Foam Expansion Joint Filler by WR Meadows or equal. Foam expansion joint filler with pre-scored removable strip for installation of joint sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to vapor retarders, including removing projections capable of puncturing vapor retarders, or of interfering with attachment.

B. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions applicable to products and application indicated.

B. Extend retarders in thickness indicated to envelop entire area to be covered. Cut and fit tightly around obstructions. Remove projections that interfere with placement.

3.4 INSTALLATION OF UNDER-SLAB VAPOR RETARDERS

A. Moisture vapor retarder system shall be installed at all interior floor slabs and as otherwise indicated in the drawings in strict accordance with the manufacturer's printed instructions and as follows:

1. Snap chalk line along inside perimeter of foundation walls at top of slab elevation.
2. Without wetting, clean a 3" wide band on the surface of the concrete below the chalk line at approximately mid-slab height. Remove dirt, residual form release, or other bond inhibiting surface contaminates. Grind smooth any surface projections within the band.
3. While removing the contact paper on the backside, firmly press 2" wide double-stick edge tape onto wall, parallel to the chalk line on the cleaned band at mid-slab elevation.
4. Remove contact paper on the face side.
5. Apply a 12" wide strip of vapor retarder covering only the bottom 1" of contact surface on the edge tape. Cut, fit, and seal corner details with vapor retarder seaming tape.
6. Align top edge of Deck-O-Foam expansion joint material to chalk line, and press material onto remaining 1" of exposed perimeter strip adhesive.
7. Roll out vapor retarder material, overlapping edge rolls and all seams by 3". Tape all seams with vapor retarder seaming tape.
8. All tears, punctures, etc. to be repaired and taped as required to maintain the watertight integrity of the vapor retarder system.

3.5 PROTECTION

A. Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where vapor retarders are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072616

SECTION 072713 - MODIFIED BITUMINOUS SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes self-adhering, vapor-retarding, modified bituminous sheet air barriers.

B. Related Requirements:

1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

B. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.7 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly , 150 sq. ft., incorporating backup wall construction, external cladding, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

    a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
    b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and complying with VOC content limits of authorities having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783 or ASTM E 2357.

2.3 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Coatings & Waterproofing Inc.; CCW-705.
b. Grace, W. R. & Co. - Conn.; Perm-A-Barrier Wall Membrane.
c. Henry Company; Blueskin SA.
d. Meadows, W. R., Inc.; SealTight Air-Shield.
e. Tremco Incorporated, an RPM company; ExoAir 110/110LT.

2. Physical and Performance Properties:

a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
b. Tensile Strength: Minimum 250 psi; ASTM D 412, Die C.
c. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
d. Puncture Resistance: Minimum 40 lbf; ASTM E 154.
e. Water Absorption: Maximum 0.15 percent weight gain after 48-hour immersion at 70 deg F; ASTM D 570.
f. Vapor Permeance: Maximum 0.05 perm; ASTM E 96/E 96M, Water Method.

2.4 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

C. Counterflashing Strip: Modified bituminous 40-mil- thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with release liner backing.

D. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner backing.

E. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

H. Modified Bituminous Transition Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick polyethylene film with release liner backing.

I. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

G. Bridge and cover isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with overlapping modified bituminous strips.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 INSTALLATION

A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.

G. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch- wide, modified bituminous strip.

H. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

J. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

K. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.

L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

M. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

N. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 072713

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.
2. Rigid insulation and Z-furring.
3. Metal soffit panels.

B. Related Sections:

1. Section 054000 "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
2. Section 072700 "Air Barriers" for continuous air barrier systems.
3. Section 076200 "Sheet Metal Flashing and Trim" for flashing and other sheet metal work that is not part of metal wall panel assemblies.

1.3 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft..

1. Water Leakage: As defined according to AAMA 501.1.
2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

a. Flashing and trim.
b. Anchorage systems.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Wall and Soffit Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- long Samples for each type of accessory.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panels and attachments.
2. Girts.
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

C. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal wall panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.

D. Fire-Resistance Ratings: Where indicated, provide metal wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall panel as shown on Drawings; approximately one bay wide by one story high by full thickness, including insulation, supports, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

E. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.11 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finish:

a. 2-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 FIELD-INSTALLED THERMAL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60-lb/cu. ft., with maximum flame-spread index of 75 and smoke-developed index of 450.

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements but not less than 18 gage.

C. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.5 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed metal wall panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Series F-12 by Morin or comparable product by one of the following:

    a. AEP-Span.
    b. Architectural Building Components.
    c. ATAS International, Inc.
    d. CENTRIA Architectural Systems.
    e. Petersen Aluminum Corporation.

2. Material: Aluminum sheet, 0.040 inch thick.

    a. Exterior Finish: 2-coat fluoropolymer.
    b. Color: Custom color to match existing metal wall panels.

3. Sealant: Factory applied within interlocking joint.
4. Panel Coverage: 12 inches.
5. Panel Height: 1.5 inches.

2.6 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal wall panels.

1. Finish: Match finish and color of metal wall panels.

C. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Series F-12 by Morin or comparable product by one of the following:

a. AEP-Span.
b. Architectural Building Components.
c. ATAS International, Inc.
d. CENTRIA Architectural Systems.
e. Petersen Aluminum Corporation.

2. Material: Same material, finish, and color as metal wall panels.

3. Panel Coverage: 12 inches.
4. Panel Height: 1.5 inches.
5. Sealant: Factory applied within interlocking joint.

2.7 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from same thickness aluminum sheet as wall panel, prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.8 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Section 072100 "Thermal Insulation."

1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches o.c.. Attach furring members to substrate with screws spaced 24 inches o.c.

3.4 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal wall panels.
2. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
3. Locate and space fastenings in uniform vertical and horizontal alignment.

4. Install flashing and trim as metal wall panel work proceeds.
5. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
6. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
7. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

E. Interlocking-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each interlocked joint at location and spacing recommended by manufacturer.

1. Interlock edges of panels. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.
3. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.

3.5 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mechanically fastened thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.
3. Fascia system.
4. Expansion joints.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 077129 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies.
4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Architect, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.

6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Fascia system.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.
3. Fascia system, of color required.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: For components of roofing system, tests performed by manufacturer and witnessed by a qualified testing agency.

D. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, and other components of roofing system.
2. Warranty Period: 25 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, covering the Work of this Section, including all components of roofing system such as roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carlisle SynTec Incorporated.
2. Firestone Building Products.
3. GAF Materials Corporation.
4. GenFlex Roofing Systems.
5. Johns Manville.
6. Stevens Roofing Systems; Division of JPS Elastomerics.
7. Versico Incorporated.

B. Source Limitations: Obtain components including roof insulation fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind speed of 100 mph (measured 30 feet above the ground).

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible TPO sheet.

1. Thickness: 60 mils, nominal.
2. Exposed Face Color: White.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. Single-Ply Roof Membrane Sealants: 250 g/L.
g. Nonmembrane Roof Sealants: 300 g/L.
h. Sealant Primers for Nonporous Substrates: 250 g/L.
i. Sealant Primers for Porous Substrates: 775 g/L.
j. Other Adhesives and Sealants: 250 g/L.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard, State of Maine VOC Compliant.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Thickness: Two or more layers of insulation, providing a total in place average R-value of 38, unless indicated otherwise. Minimum thicknes or 2 inches.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Cover Board: Provide High Density insulation board, 1/2 inch thick, similar to Isogard™ Cover Board by Firestone.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

2.8 FASCIA SYSTEM

A. Provide fasciae in shapes and sizes indicated. Include anchor plates; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.

1. Provide scupper components where indicated on the drawings.

B. Provide exposed fascia components fabricated from the following metal:

1. Extruded aluminum in thickness indicated, but not less than 0.040 inch.
2. Finish: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method 7. Color as selected by the Architect.
3. Product:

a. Hickman: Extruded TerminEdge Roof Edging.
b. Metal-Era: Anchor-Tite Fascia System.
c. Provide face size as indicated on the drawings.

2.9 EXPANSION JOINTS

A. Deck-To-Deck and Deck-To-Wall Expansion Joints: Provide manufacturers standard joint system consisting of expansion joint support or support sponge, anchor plates, and flashing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Install insulation strips according to acoustical roof deck manufacturer's written instructions.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Loosely Laid Insulation: Loosely lay insulation units over substrate.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards according to requirements of manufacturer for specified warranty and performance.

3.5 MECHANICALLY FASTENED ROOFING INSTALLATION

A. Mechanically fasten roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

1. For in-splice attachment, install roofing with long dimension perpendicular to steel roof deck flutes.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten or adhere roofing securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing with side laps shingled with slope of roof deck where possible.

F. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.

2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FASCIA SYSTEM INSTALLATION

A. Comply with manufacturer's written installation instructions. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.

B. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

3.9 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed low-slope roof sheet metal fabrications.
2. Formed wall sheet metal fabrications.

B. Related Requirements:

1. Section 075423 "TPO Roofing" for materials and installation of sheet metal flashing and trim integral with roofing.
2. Section 074213 "Metal Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
3. Section 084113 "Aluminum-Framed Entrances and Storefront" for break metal flashing and trim integral with storefront system.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.

4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of edge conditions, including eaves, and counterflashings as applicable.
9. Include details of special conditions.
10. Include details of connections to adjoining work.
11. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

D. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
2. Fabricate from the Following Materials:

a. Aluminum: 0.050 inch thick.

B. Roof-to-Wall Transition Counterflashing: Fabricate from the following materials:

a. Aluminum: 0.050 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes sprayed fire-resistive materials (SFRM).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans, schedules, or both, indicating the following:

1. Extent of fireproofing for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of fireproofing after application.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fireproofing.

B. Evaluation Reports: For fireproofing, from ICC-ES.

C. Preconstruction Test Reports: For fireproofing.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

E. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. SFRM Insert drawing designation: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; RPM International; Pyrolite 15.
b. Grace Construction Products; W.R. Grace & Co. -- Conn; Grace Construction Products; Monokote MK-6 Series.
c. Isolatek International, Inc; Cafco 300.

2. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E 736.

3. Density: Not less than 15 lb/cu. ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
4. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch.
5. Combustion Characteristics: ASTM E 136.
6. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 10 or less.
    b. Smoke-Developed Index: 0.

7. Compressive Strength: Minimum 1,200 lbf/sq. in. according to ASTM E 761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
13. Finish: Spray-textured finish.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.

C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Verify that concrete work on steel deck has been completed before beginning fireproofing work.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work is complete before beginning fireproofing work.

D. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit roof traffic during application and drying of fireproofing.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

F. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

G. Extend fireproofing in full thickness over entire area of each substrate to be protected.

H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.

J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

K. Cure fireproofing according to fireproofing manufacturer's written recommendations.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

M. Finishes: Where indicated, apply fireproofing to produce the following finishes:

1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector (to be scheduled by the Contractor) to perform the following special inspections:

1. Test and inspect as required by the IBC, 1704.10.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.

1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

3.6 SCHEDULE

A. Columns: 2 hour.

B. Floors (beams & deck): 2 hour.

C. Roofs: 1 hour.

END OF SECTION 078100

MONOKOTE® MK-6®, MK-6/HY® and MK-6s

Product data and application instructions

Product Description

Monokote® MK-6®/HY® and MK-6s are single component, spray applied, mill-mixed fire resistive plasters. MK-6/HY and MK-6s have approval for use on structural steel members and fluted decking to provide up to four hours of fire protection, and on flat plate cellular decking for up to three hours with Spatterkote® SK-3.

Note: Monokote MK-6/HY and MK-6s afford the same level of the fire protection at identical protection thicknesses. By simply specifying "Monokote MK-6," the fireproofing subcontractor can select the product that will provide the most efficient fire protection for the specific project conditions.

Features & Benefits

Monokote cementitious fireproofing offers many significant advantages to the architect, owner, applicator and building occupant. These include:

- Proven in-place performance
- Low in-place cost
- Fast, efficient application
- UL fire tested and factory inspected
- Building Code compliant (ICBO, SBCCI, BOCA, ICC)

Delivery & Storage

a. All material to be used for fireproofing shall be delivered in original unopened packages bearing the name of the manufacturer, the brand and proper UL labels for fire hazard and fire resistance classifications.

b. The material shall be kept dry until ready for use. Packages of material shall be kept off the ground, under cover and away from sweating walls and other damp surfaces. All bags that have been exposed to water before use shall be discarded. Stock of material is to be rotated and used before its expiration date.

Steel & Concrete Surfaces

a. Prior to the application of Monokote MK-6, an inspection shall be made to determine that all steel surfaces are acceptable to receive fireproofing. The steel shall be free of oil, grease, rolling compounds or lubricants, loose mill scale, excess rust, noncompatible primer, lock down agent or any other substance that will impair proper adhesion. Where necessary, the cleaning of steel surfaces to receive fireproofing shall be the responsibility of the general contractor.

b. The project architect shall determine if the painted/primed structural steel to receive fireproofing has been tested in accordance with ASTM E119, to provide the required fire resistance rating.

c. Many Fire Resistance Designs allow the use of painted metal floor or roof-deck in place of galvanized decking. Painted decking must be UL listed in the specific fire resistance designs and must carry the UL classification marking. Consult your local Grace sales representative for details.

d. Prior to application of Monokote MK-6, a bonding agent, approved by the fireproofing manufacturer, shall be applied to all concrete substrates to receive MK-6.

e. Fireproofing to the underside of roof deck assemblies shall be done only after roofing application is complete and roof traffic has ceased.

f. No fireproofing shall be applied prior to completion of concrete work on steel decking.

Performance Characteristics

Physical Properties	Recommended Specification	Typical Values	Test Method
Dry density, minimum average	15 pcf (240 kg/m^3)	15 pcf (240 kg/m^3)	ASTM E605
Bond strength	200 psf (9.6 KPa)	339 psf (16.2 KPa)	ASTM E736
Compression, 10% deformation	1,200 psf (51 KPa)	1,483 psf (71.0 KPa)	ASTM E761
Air erosion	Max 0.000 g/ft^2 (0.00 g/m^2)	0.000 g/ft^2 (0.00 g/m^2)	ASTM E859
High velocity air erosion	No continued erosion after 4 hours	No continued erosion after 4 hours	ASTM E859
Corrosion	Does not contribute to corrosion	Does not contribute to corrosion	ASTM E937
Bond impact	No cracking, spalling or delamination	No cracking, spalling or delamination	ASTM E760
Deflection	No cracking, spalling or delamination	No cracking, spalling or delamination	ASTM E759
Resistance to mold growth	No growth after 28 days	No growth after 28 days	ASTM G21
Surface burning characteristics	Flame spread = 0 Smoke developed = 0	Flame spread = 0 Smoke developed = 0	ASTM E84
Combustibility	Less than 5 MJ/m^2 total, 20 kw/m^2 peak heat release	Less than 5 MJ/m^2 total, 20 kw/m^2 peak heat release	ASTM E1354
Impact penetration	Max 6 cm^3 abraded	3.9 cm^3	City of San Francisco
Abrasion resistance	Max 15 cm^3 abraded	8.3 cm^3	City of San Francisco

g. Other trades shall not install ducts, piping, equipment, or other suspended items until the fireproofing is completed and inspected.

h. Other trades shall install clips, hangers, support sleeves, and other attachments that penetrate the fireproofing, prior to application of the fireproofing.

Mixing

a. Monokote Fireproofing shall be mixed by machine in a conventional, plaster-type mixer or a continuous mixer specifically modified for cementitious fireproofing. The mixer shall be kept clean and free of all previously mixed material. The mixer speed in a conventional mixer shall be adjusted to the lowest speed which gives adequate blending of the material and a mixer density of 40–45 pcf (640–720 kg/m^3) of material.

b. Using a suitable metering device and a conventional mixer, all water shall be first added to the mixer as the blades turn. Mixing shall continue until the mix is lump-free, with a creamy texture. All material is to be thoroughly wet. Target density of 43 ± 1 pcf (688 ± 16 kg/m^3) is most desirable. Overmixing Monokote will reduce pumping rate.

Application

a. Application of Monokote Fireproofing can be made in the following sequence:
   1. For thicknesses of approximately ½ in. (13 mm) or less, apply in one pass.
   2. For thicknesses of ⅝ in. (16 mm) or greater, apply subsequent passes after the first coat has set.

b. Spatterkote SK-3 shall be applied to all cellular steel floor units with flat plate on the bottom and to roof decking where required prior to application of Monokote. Spatterkote shall be applied in accordance with manufacturer's application instructions.

c. Monokote Fireproofing material shall not be used if it contains partially set, frozen or caked material.

d. The minimum average density shall be that required by the manufacturer, listed in the UL Fire Resistance Directory for each rating indicated, ICBO Evaluation Report, as required by the authority having jurisdiction, or minimum average 15 lbs/ft^3 (240 kg/m^3), whichever is greater.

e. Monokote shall be mixed with water at the job site.

f. Monokote Accelerator is to be used with Monokote Fireproofing* to enhance set characteristics and product yield. The Monokote Accelerator is injected into the Monokote Fireproofing at the spray gun. Monokote Accelerator shall be mixed and used according to manufacturers recommendations.

g. Monokote is applied directly to the steel, at various rates of application which will be job dependent, using standard plastering type equipment or continuous mixer/pump units. A spray gun, with a properly sized orifice and spray shield and air pressure at the nozzle of approximately 20 psi (38 KPa), will provide the correct hangability, density and appearance. NOTE: If freshly sprayed Monokote does not adhere properly, it is probably due to a too wet mix, poor thickness control, or an improperly cleaned substrate.

Temperature & Ventilation

a. An air and substrate temperature of 40°F (4.4°C) minimum shall be maintained for 24 hours prior to application, during application and for a minimum of 24 hours after application of Monokote.

b. Provisions shall be made for ventilation to properly dry the fireproofing after application. In enclosed areas lacking natural ventilation, air circulation and ventilation must be provided to achieve a minimum total fresh air exchange rate of 4 times per hour until the material is substantially dry.

Field Tests

a. The architect will select an independent testing laboratory (for which the owner will pay) to sample and verify the thickness and density of the fireproofing in accordance with the provisions of ASTM E605, *Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members* or Uniform Building Code Standard No. 7-6 *Thickness and Density Determination for Spray Applied Fireproofing*.

b. The architect will select an independent testing laboratory (for which the owner will pay) to randomly sample and verify the bond strength of the fireproofing in accordance with the provisions of ASTM E736.

c. Results of the above tests will be made available to all parties at the completion of pre-designated areas which shall have been determined at a pre-job conference.

Safety

a. Monokote is slippery when wet. The general contractor and applicator shall be responsible for posting appropriate cautionary "SLIPPERY WHEN WET" signs. Signs should be posted in all areas in contact with wet fireproofing material. Anti-slip surfaces should be used on all working surfaces.

b. Material Safety Data Sheets for Monokote MK-6/HY and MK-6s are available on our web site at www.graceconstruction.com or by calling 866-333-3SBM.

* Use of accelerator with MK-6s will provide rapid set but will not result in yield increase.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

MK-515G Printed in U.S.A. 06/10 FA/PDF

GRACE

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.
3. Penetrations in smoke barriers.

B. Related Sections:

1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."

C. Special Inspections: Allow for 1 of each type of firestopping system to be removed and inspected for conformance with approved submittals. All firestopping shall be inspected prior to the installation of ceilings.

D. Above Ceiling review: Prior to the installation of ceilings, a review of construction completion shall be conducted for firestopping and other items that will not be visible when the ceilings have been installed.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Grace, W. R. & Co. - Conn.
2. Hilti, Inc.
3. Nelson Firestop Products.
4. RectorSeal Corporation (The).
5. Specified Technologies Inc.
6. 3M; Fire Protection Products Division.
7. Tremco; Sealant/Weatherproofing Division.
8. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

G. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:

a. Slag-wool-fiber or rock-wool-fiber insulation.
b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
c. Fire-rated form board.
d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials as required by UL approved Through-Penetration Firestop System. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

L. Unfaced, Slag-Wool-/Rock-Wool-Fiber Board Insulation: ASTM C 612, maximum flame-spread and smoke-developed indices of 15 and 0, respectively; passing ASTM E 136 for combustion characteristics; and of the following density, type, thermal resistivity, and fiber color:

1. Nominal density of 4 lb/cu. ft., Types IA and IB, thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Color: Natural.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fibrex Insulations Inc.
b. Owens Corning.
c. Thermafiber.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Install board insulation in exterior wall construction where indicated on Drawings.

E. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.

2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

B. Do not install identification on exposed finished wall locations.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

D. Reinstall firestopping materials that have been removed for inspection.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

Specified Technologies Inc.

THE FIRESTOP AUTHORITY

FIRESTOPPING

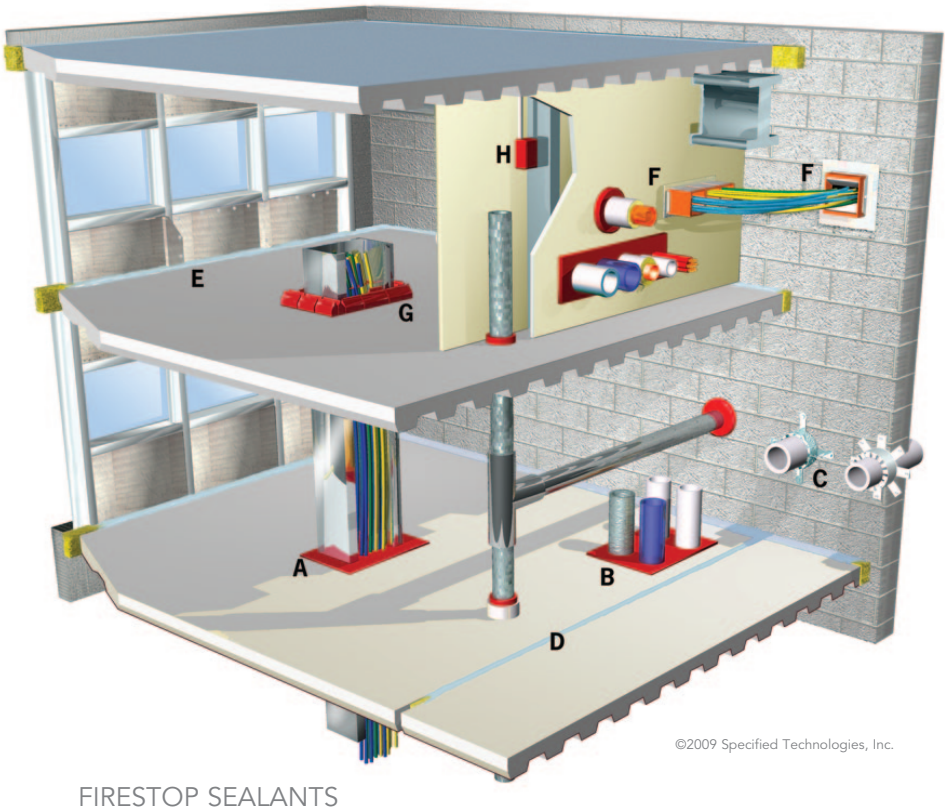
Products for Life Safety and Code Compliance

www.stifirestop.com

PRODUCT SELECTOR

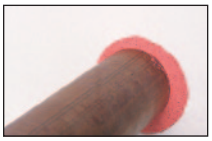
SPECIFIED TECHNOLOGIES INC.
Specified Technologies Inc. (STI) is an industry leader solely committed to the development of innovative, reliable firestopping solutions that help stop the spread of fire, smoke and toxic fumes.

For over 25 years, our management team has worked hand in hand with the construction industry to create innovative firestop solutions for all types of new construction and retrofit applications. We offer the broadest range of UL® Classified Systems — more than any other manufacturer. We keep material requirements to a minimum and we design systems with the installer in mind. The result is less labor and significantly lower installed costs.



FIRESTOP SEALANTS

Triple S® Intumescent Sealant — Pg. 4
Premium grade intumescent firestop sealant featuring STI's patented two-stage intumescent technology. Triple S can be used in most common through-penetrations as well as a variety of membrane penetrations and construction joints.



LCI Intumescent Sealant — Pg. 4
Standard grade intumescent firestop sealant engineered to economically address many common through-penetration applications in light commercial construction.

LC Endothermic Sealant — Pg. 5
High quality, non-halogenated firestopping sealant designed for non-combustible penetrants in through-penetrations and construction joints.

PENSIL® Silicone Products — Pg. 7
A 100% silicone firestop caulk engineered to rapidly cure and resist washout (W Ratings) when used in exposed applications. Also used in construction joint applications.

RESIDENTIAL CAULK

WF300 Firestop Caulk — Pg. 5
Intumescent firestop caulk designed for sealing through-penetrations and gaps in fire resistance-rated wood frame construction.

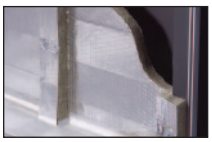
SmokeBlock® E-136 Caulk — Pg. 5
Meets the requirement of ASTM E136 for use in non-rated applications for fireblocking and draftstopping.

FIRESTOP SPRAYS & JOINT SEALANT

ES Elastomeric Sealant — Pg. 6
Non-halogenated latex-based sealant designed to provide passive smoke and fire protection in construction joint applications.

AS Elastomeric Spray — Pg. 6
Water-based, spray applied coating for joints and certain through-penetrations in fire-rated walls or floors.

FIRESTOP SPRAYS & JOINT SEALANT



Fast Tack™ Firestop Spray — Pg. 7
Quick dry, firestop spray for use in curtain wall/ edge of slab, and general construction joints that are subject to movement.

PENSIL® Silicone Products — Pg. 7
A 100% silicone firestop caulk engineered to rapidly cure and resist washout (W Ratings) when used in exposed applications. Also used in through penetration applications.

SMOKE & ACOUSTICAL PRODUCTS

Smoke 'N' Sound Acoustical Spray — Pg. 8
Spray grade product for sealing openings in non-rated smoke barriers and partitions.

Smoke 'N' Sound Acoustical Sealant — Pg. 8
Sealant grade product for sealing openings in non-rated smoke barriers and partitions.

CONSTRUCTION JOINT SYSTEM

SpeedFlex™ Joint System — Pg. 9
A quick, economical alternative to using strips of mineral wool forming material in the joint area between the fire-rated wall assembly and the bottom of a steel deck or concrete floor.

FIRESTOP ANGLE

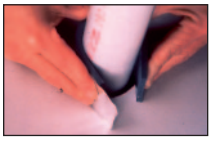
FyreFlange™ Duct Angle — Pg. 9
Duct support and firestopping in one product.

FIRESTOP COLLARS

Firestop Collars — Pg. 10
Ready-to-use firestop devices designed to collapse plastic pipe penetrations when exposed to fire conditions.

Range-Taking Collars — Pg. 10
Factory-manufactured device designed to seal plastic pipes penetrating fire resistance rated walls and floors. SpecSeal® RTC Collars are designed to allow a single collar to fit 3" and 4" trade size pipes (89 and 114 mm) and corresponding 3" and 4" couplings (102 and 127 mm).

WRAP STRIPS & RESTRAINING COLLARS



SSW Wrap Strips — Pg. 11
Intumescent, flexible wrap strips for through-penetrations.

WSC Restraining Collars — Pg. 11
Preformed metal restraining collars for use with SSW Wrap Strips in plastic pipe applications.

FIRESTOP ACCESSORIES

Firestop Accessories — Pg. 11
STI has several accessories available for installing firestop. Caulk tubes, mineral wool boards and even warning labels for labeling your barriers.

PATHWAYS

EZ-Path® Fire Rated Pathway — Pg. 12-15
A mechanical cable pathway system utilizing a self-contained, self-sealing firestop system. Easy moves, adds, and changes with no firestopping required ever. Three sizes and a full range of accessories adapt this system to virtually any application.

COMPOSITE SHEET

Composite Sheet — Pg. 16
Lightweight, firestop panels effectively seal medium to large openings with a variety of penetrants in fire-rated floors and walls.

FIRESTOP MORTAR

SSM Firestop Mortar — Pg. 16
Lightweight, cementitious, compound suitable for openings of all sizes in fire-rated construction.

FIRESTOP PILLOWS

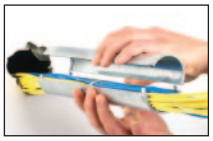
SSB Intumescent Firestop Pillows — Pg. 17
Intumescent firestop pillows expand in all directions for a tough, tight seal and easy retrofit for hard-to-fill, multiple penetrants, and large openings.

FIRESTOP PUTTY

SSP Putty — Pg. 17
Two-stage intumescent, non-hardening putty for cable and pipe penetrations. Ideal in small to medium sized applications that will require re-entry.

FIRESTOP SLEEVES

Ready™ Sleeve — Pg. 18
Complete firestop sleeve assembly for new cable installations. Includes all mounting hardware and internal and external firestop sealing materials. Available in 1", 2", and 4" sizes with standard or large escutcheon plates.



Ready™ Split Sleeve — Pg. 18
Complete firestop split sleeve assembly for new or existing cable installations. Includes all mounting hardware and internal and external firestop sealing materials. Available in 1", 2", and 4"sizes.

PUTTY PADS

SSP Putty Pads — Pg. 19
When used with both metallic and non-metallic switch and receptacle boxes, pads are UL Tested and Classified to permit larger boxes and reduced spacing.

ELECTRICAL BOX INSERTS

Powershield™ Electrical Box Inserts — Pg. 19
When used within metallic switch and receptacle boxes, inserts are UL tested and Classified to permit larger boxes and reduced spacing.

FIRE PROTECTIVE CABLE COATING

Cable Spray — Pg. 19
Water-based, spray applied coating used to provide short term circuit integrity and improved flame spread characteristics for grouped electrical cables.

TRIPLE S® INTUMESCENT SEALANT

Premium, multi-viscosity grade sealant for commercial and industrial applications. The original and still the best multi-purpose sealant.

FEATURES & BENEFITS:

- Patented two-stage intumescent technology - extremely fast and directionalized expansion.
- Water-based - easy installation, cleanup and disposal.
- Excellent smoke seal.
- Low shrinkage.
- Acoustically tested - reduces noise transmission.
- Sandable and paintable (when dry).
- Water-resistant - will not re-emulsify when dry!
- Safe - low VOCs, no solvents, non-halogenated.
- Red color - easy identification and inspection.

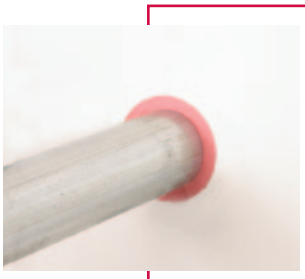
APPLICATIONS

- Metallic pipes including steel, iron, or copper pipe and tubing.
- Nonmetallic pipes, conduits and tubing including PVC, CPVC, PVDF, PEX, PEX-AL-PEX, ABS and PB.
- Cable, cable trays and bus duct.
- HVAC ductwork.
- Insulated pipes.
- Multi-service penetrations including AC line sets, electrical, telephone, or TV service entrance and interior penetrations.
- Complete wood floor firestopping package for electrical, plumbing, HVAC, TV and telephone.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01100	SSS100	Intumescent Sealant 10.1 oz. Tube (18.2 Cu. In., 300 ml)	1	12	0.90
01102	SSS102	Intumescent Sealant 2 gal. Pail (462 Cu. In., 7.6 L)	1	n/a	20.00
01105	SSS105	Intumescent Sealant 5 gal. Pail (1155 Cu. In.,19.0 L)	1	n/a	50.00
01103	SSS120	Intumescent Sealant 20 oz. Sausage (36 Cu. In., 592 ml)	1	12	1.55
01129	SSS129	Intumescent Sealant 29 oz. Tube (52 Cu. In., 858 ml)	1	10	2.49

LCI INTUMESCENT SEALANT



A Great Combination of Price and Performance in a Firestop Sealant SpecSeal® Series LCI is a standard grade intumescent sealant specifically engineered and tested to economically address many common firestop applications that represent a significant part of the overall market.

FEATURES & BENEFITS:

- Commercial grade sealant.
- Fast-acting intumescence - expands up to 10X.
- Water-based - easy installation, cleanup, and disposal.
- Excellent smoke seal.
- Water-resistant - will not re-emulsify when dry.
- Acoustically tested - reduces noise transmission.
- Safe - low VOCs, no solvents, non-halogenated.

FGG =BM= CZ™ SYSTEM COMPATIBLE

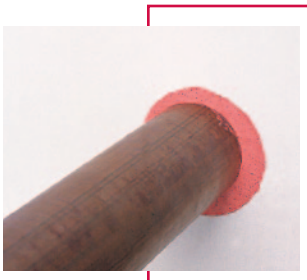
APPLICATIONS

- Metallic pipes including steel, iron, or copper pipe and tubing.
- Nonmetallic pipes, conduits and tubing including PVC, CPVC, ABS, and PEX.
- Electrical and electronic cabling including service entrance, power distribution, computer, telephone, and television.
- Metal duct work including HVAC, bath and dryer vents.
- Insulated pipes including heating, cooling, and condensation applications.
- Complete wood floor firestopping package for electrical, plumbing, HVAC, telephone, and television.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01170	LCI300	Intumescent Sealant 10.1 oz. Tube (18.2 Cu. In., 300 ml)	1	12	0.94
01175	LCI305	Intumescent Sealant 5 gal Pail (1,155 Cu. In.,19.0 L)	1	n/a	50.00
01172	LCI320	Intumescent Sealant 20 oz. Sausage (36 Cu. In., 592 ml)	1	12	1.59
01179	LCI329	Intumescent Sealant 29 oz. Tube (52 Cu. In., 858 ml)	1	10	2.27

LC ENDOTHERMIC SEALANT



LC Sealant is a latex-based, high solids firestop compound. When properly installed, it effectively seals penetration openings against the spread of fire, smoke and toxic gases.

FEATURES & BENEFITS:

- Water-based - easy installation, cleanup and disposal.
- Endothermic fillers - absorb heat and release water.
- High solids formula - no shrinkage!
- Paintable (when dry).
- Safe - low VOCs, no solvents, non-halogenated.
- Red color - easy identification and inspection.
- Excellent caulking properties along with high build capabilities.
- Excellent smoke seal.
- Flexible!

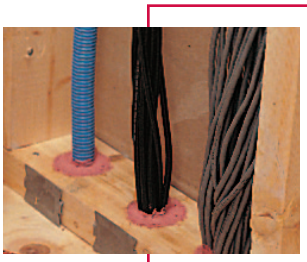
APPLICATIONS

- Piping: non-combustible steel, iron, cast iron and copper up to 24" in diameter.
- Complex multiple penetrants
- Communication cabling systems.
- Construction joints.
- HVAC ducts.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01130	LC150	Endothermic Sealant 10.1 oz Tube 18.2 Cu. In. (300 ml)	1	12	0.94
01135	LC155	Endothermic Sealant 5 gal. Pail 1,155 Cu. In. (19.0 L)	1	n/a	58.00
01133	LC120	Endothermic Sealant 20 oz. Sausage 36 Cu. In. (592 ml)	1	12	1.92
01131	LC129	Endothermic Sealant 29 oz. Tube 52 Cu. In. (858 ml)	1	10	1.92

WF300 INTUMESCENT FIRESTOP CAULK



BlazeStop™ Series WF300 Firestop Caulk is designed for use in sealing through-penetrations and gaps in fire resistance-rated wood frame construction.

FEATURES & BENEFITS:

- Economical - delivers maximum fire protection at the right price.
- Water-based - easy installation, clean-up and disposal.
- Water-resistant - will not re-emulsify.
- Intumescent - expansion fills gaps or voids caused by wood shrinkage, or burning or melting of combustible materials.
- Meets ASTM E814 (ANSI/UL 1479).
- Acoustically tested – reduces noise transmission.

APPLICATIONS

- Through-penetrations and gaps in wood frame construction.

SYSTEM COMPATIBLE

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
09710	WF310	Wood Frame Caulk 10.1 oz. Tube (18.2 Cu. In., 300 ml)	1	12	0.94
09705	WF305	Wood Frame Caulk 5 gal. Pail (1, 155 Cu. In., 19.0 L)	1	n/a	58.00
09720	WF320	Wood Frame Caulk 20 oz. Sausage (36 Cu. In., 592 ml)	1	12	1.92

SMOKEBLOCK® E-136 CAULK

SmokeBlock® Caulk is a non-combustible caulking product that meets the requirements of ASTM E 136 for use in non-rated applications for fireblocking and draftstopping.

FEATURES & BENEFITS:

- Up to 1000˚F and more severe one-time exposures.
- Light red color - easy identification and inspection.
- Quality non-sag sealer.
- Water-based - easy installation, clean-up and disposal.
- Construction grade quality - no shaking or mixing required.
- Adheres to wood and masonry building materials.
- Conforms to the Model Energy Code - minimizes airflow within the wall.

APPLICATIONS

- Non-rated construction.
- Wood frame walls and floors.
- Building structures that do not exceed 3 stories.
- Wherever E-136 materials are required.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01160	SB100	Draft, Smoke and FireBlocking Sealer 10.1 oz. (300ml)	1	12	1.21

ES ELASTOMERIC SEALANT

Flexible Firestop Protection for Fire Rated Joints.

FEATURES & BENEFITS:

- Elastomeric - allows movement.
- Water-based - easy installation, clean up and disposal.
- Auto-bonding.
- Compatible with AS Spray for applications or repairs.
- Safe - low VOCs, no solvents, non-halogenated.
- Water-resistant - will not re-emulsify when dry.
- Acoustically tested - reduces noise transmission.

See compatible spray grade AS Spray

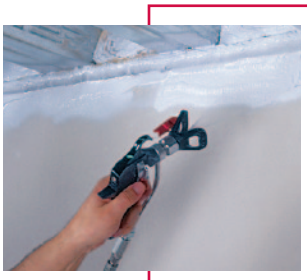
APPLICATIONS

- Control/expansion joints.
- Slab edge conditions.
- Head of wall - concrete fluted and slab.
- Bottom of wall-deck to gypsum wall.
- Joints and gaps in sound barriers.

ORDERING INFORMATION

UPC #	3Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
08100	ES100	Elastomeric Sealant 10.1 oz. Tube (18.2 Cu. In., 300 ml)	1	12	1.12
08105	ES105	Elastomeric Sealant 5 gal. Pail (1, 155 Cu. In., 19.0 L)	1	n/a	62.00
08103	ES120	Elastomeric Sealant 20 oz. Sausage (36 Cu. In., 592 ml)	1	12	1.96
08129	ES129	Elastomeric Sealant 29 oz. Tube (52 Cu. In., 858ml)	1	10	3.04

AS ELASTOMERIC SPRAY



The Professional's Choice for Spray-Applied Firestop Protection of Joints and Penetrations.

FEATURES & BENEFITS:

- Original quick-dry elastomeric formula.
- Water-based - for easy installation, clean-up and disposal.
- Thixotropic - superior high-build properties.
- Safe - low VOCs, no solvents, non-halogenated.
- Auto-bonding - may be re-coated or repaired using ES Caulk.
- Low abrasion - for longer pump life and less maintenance.
- Tested with direct-applied fireproofing.
- Acoustically tested - reduces noise transmission.
- Water-resistant - will not re-emulsify when dry.

See compatible sealant grade ES Sealant

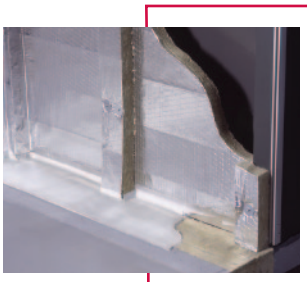
APPLICATIONS

- Slab edge/Curtain wall conditions.
- Head of wall - concrete fluted deck to gypsum wall.
- Head of wall - concrete slab to masonry wall.
- Control/expansion joints (wall & floor).
- Metallic pipes.
- Steel ducts.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
07107	AS205	Elastomeric Spray (Construction Joints) 5 gal. (1,155 Cu. In., 19.0 L) Pail	1	n/a	50.00

FAST TACK™ FIRESTOP SPRAY



The Curtain Wall Firestop Spray that Won't Wash Out!

Silicone/urethane hybrid formula provides fire protection for construction joints, curtain walls, and applications in concrete floors. Fast Tack™ Firestop Spray is well suited for use around penetrants subject to vibration or movement or in areas that may be prone to washouts or exposure to water and moisture.

FEATURES & BENEFITS:

- All-weather formula.
- Skins over quickly to resist water.
- Quick-dry/tack-free in 2-4 hours.
- For use in extreme weather conditions, such as cold or rain.
- Cures below freezing.
- Can be top coated, spray coated or flow applied.
- Auto-bonds for easy touch ups.

APPLICATIONS

- Slab Edge/Curtain wall conditions.
- Floor to floor joints.
- Floor to wall joints.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01192	FT302	Fast-Tack Firestop Spray 2 gal. (7.6 L) Pail	1	n/a	20.00
01190	FT305	Fast-Tack Firestop Spray 5 gal. (19.0 L) Pail	1	n/a	49.00

PENSIL® SILICONE SEALANT

A 100% silicone firestop caulk engineered to rapidly cure and resist washout when used in exposed conditions.

FEATURES & BENEFITS:

- Low modulus - allows up to ± 50% movement in joints.
- Auto-bonding - allows fresh sealant to adhere to cured sealant.
- Excellent water-resistance - for water-tight sealing.
- Ozone and UV-resistant - for excellent weathering ability and long service life.
- Excellent chemical resistance - protects in polluted or corrosive atmospheres.
- Excellent adhesion to most building substrates.
- UL tested for W ratings.
- Acoustically tested - reduces noise transmission

APPLICATIONS

- Through penetrations with high temperatures or movement.
- Electrical, data, or telephone cables.
- Slab Edge/Curtain wall, safing and construction gaps.
- Seismic and expansion joints.
- Curtain wall safing applications.
- Top-of-wall joints.
- Single or multiple metallic pipes, conduits & tubing.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01120	PEN300	Silicone 10.3 oz. Tube (18.5 Cu. In., 304 ml)	1	24	1.10
01125	PEN305	Silicone 5 gal. Pail (1,155 Cu. In., 19.0 L)	1	n/a	56.00
01126	PEN305SL	Self-Leveling Silicone 5 Gal. Pail (1,155 Cu. In., 19.0 L)	1	n/a	56.00
01123	PEN320	Silicone 20 oz. Tube (36 Cu. In. (592ml)	1	12	1.94

SMOKE 'N' SOUND ACOUSTICAL SPRAY

FEATURES & BENEFITS:

- Water-based - for easy installation and clean-up.
- Excellent smoke seal.
- Acoustically tested - reduces noise transmission.
- High build characteristics.
- Safe. Low VOCs. No solvents! Non-halogenated.
- Economical spray application saves labor!

See compatible sealant grade Acoustical Sealant

APPLICATIONS

- Smoke Control: Where stopping the passage of smoke is necessary such as in smoke barrier walls.
- Noise Control: Where reducing the transmission of sound through wall openings is necessary to help ensure occupant privacy and peaceful environment.
- Infectious/Dust Control: Where reducing the transmission of dust and other airborne particulates through wall openings is necessary.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01155	SNS205	Smoke & Acoustical Spray 5 Gal. Pail (1,155 Cu. In., 19.0 L)	1	n/a	68.00

SMOKE 'N' SOUND ACOUSTICAL SEALANT

Smoke 'N' Sound Acoustical Sealant is a high quality acrylic latex sealant designed for sealing through-penetrations (such as pipes, conduits, cabling, busways, openings) and membrane penetrations (such as p-traps and outlet boxes) in smoke rated walls.

FEATURES & BENEFITS:

- Economical - high performance without the high price!
- Safe for contact with plastics.
- Water-resistant - will not re-emulsify when dry.
- Water-based - easy installation, cleanup, and disposal.
- Remains Flexible - allows movement.
- Acoustically Tested - reduces noise transmission.
- Safe. Low VOCs. No solvents! Non-halogenated.

See compatible spray grade Acoustical Spray

APPLICATIONS

- Smoke Control: Where stopping the passage of smoke is necessary such as in smoke barrier walls.
- Noise Control: Where reducing the transmission of sound through wall openings is necessary to help ensure occupant privacy and peaceful environment.
- Infectious/Dust Control: Where reducing the transmission of dust and other airborne particulates through wall openings is necessary.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
01154	SNS105	Smoke 'N' Sound Sealant Yellow - 5 Gal. Pail 1,155 Cu. In. (19.0 L)	1	1	68.00
11154	SNS105W	Smoke 'N' Sound Sealant White - 5 Gal. Pail 1,155 Cu. In. (19.0 L)	1	1	70.80
11151	SNS120W	Smoke 'N' Sound Sealant White - 20 oz. Sausage 36 Cu. In. (592 ml)	1	12	2.06

SPEEDFLEX™ JOINT SYSTEM

Patent 7, 240, 905

The Speedflex Joint System combines a unique backer product with SpecSeal® spray-applied coatings. This system installs over joints rather than within them to allow maximum joint movement (±100%). Excellent repair system for cracked or improperly sealed joints.

FEATURES & BENEFITS:

- Seismic testing.
- Replaces mineral wool in construction joints.
- Tested to ASTM E 1966 and ANSI/UL 2079.
- Clean, professional appearance.
- Can be used to repair cracked joints.
- Use with other SpecSeal® Firestop Products.

APPLICATIONS

- Head of wall construction joints.
- Fluted deck.
- Flat slab.
- Repair/retrofit of cracked joints.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
08144	SFJP40	Fire Rated Joint Profile Forming Material	1	100	1.00

FYREFLANGE™ DUCT ANGLE

FyreFlange™ firestop angle provides duct support and firestopping in one product. It has a factory applied intumescent gasket and is designed and engineered to eliminate the need for firestop caulk and backing materials. FyreFlange™ saves time and labor while providing excellent fire protection.

FEATURES & BENEFITS:

- Single stage installation.
- Economical - saves labor.
- Clearly marked for easy inspection.
- Red color for easy identification.
- No additional firestop or backing materials required.
- Eliminates the need for multiple inspections.
- Can be installed over or under duct insulation.

APPLICATIONS

- For use with max. 2 in. thick light density insulation, insulated or non-insulated ducts in walls.
- UL Classified® sytems for HVAC ducts through gypsum and masonry walls.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
32208	FFA2208	Fyreflange Steel Angle 2" x 2" x 96" (51 mm x 51 mm x 244 cm)	1	6	4.25
30022	FFC22	Corner Angle Pack - 8 per pack	1	n/a	.81
30023	FFS22	Fyreflange Splice - 6 per pack	1	n/a	.70

INTUMESCENT FIRESTOP COLLARS

The Right Combination of Price & Performance.

The economical solution for firestopping common plastic pipe that doesn't compromise safety or performance.

FEATURES & BENEFITS:

- Easy installation - uses STI's quick closure design.
- Compact profile - use it in all the tight spots!
- Water-resistant - no water soluble or hygroscopic ingredients.
- Fast-acting expansion (up to 60X) - to seal off burning pipes.
- Safe for contact with plastics.

APPLICATIONS

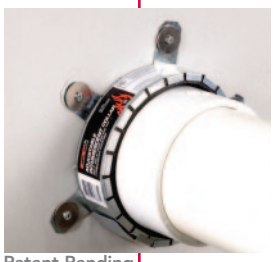
- Combustible penetrants (factory manufactured).
- Protects a variety of plastic pipes - PVC, PVC Foam Core (ccPVC), CPVC, ABS, and ABS Foam Core (ccABS).
- Vented (DWV) and closed (electrical conduit and water supply) installations.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
03901	LCC150	For 1.5" (3.8 cm) Dia. Plastic Pipe	1	6	0.22
03902	LCC200	For 2.0" (5.1 cm) Dia. Plastic Pipe	1	6	0.25
03903	LCC300	For 3.0" (7.6 cm) Dia. Plastic Pipe	1	6	0.49
03904	LCC400	For 4.0" (10.2 cm) Dia. Plastic Pipe	1	6	0.73
03600	SSC600	For 6.0" (15.2 cm) Dia. Plastic Pipe	1	2	4.67

NEW!

RTC INTUMESCENT FIRESTOP COLLARS



Patent Pending

Factory-manufactured device designed to seal plastic pipes penetrating fire rated walls and floors.

FEATURES & BENEFITS:

- Adjustable - one collar fits 3" and 4" pipes and corresponding couplings.
- Rapid expansion - closes off burning pipes quickly.
- Small profile - use it in all the tight spots!
- Flexible and durable - no loose flakes (eye hazards).
- Water-resistant - no water soluble or hygroscopic ingredients.
- Economical - lower installed cost.
- High volume char - expands up to 60 times!
- Replaces traditional field-erected wrap strip/restraining collar systems for pipe couplings.
- Reduces inventory - one convenient product covers 3 and 4 in. trade size pipes. Use caulk for 2 in. and smaller trade size pipes!

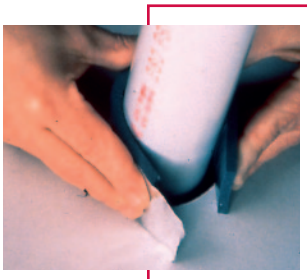
APPLICATIONS

- Protects a variety of plastic pipes and couplings including PVC, PVC Cellular Core (ccPVC), CPVC, ABS, and ABS Cellular Core (ccABS).
- Both vented (DWV) and closed (electrical conduit or water supply) installations.
- All common constructions including concrete floors, concrete over steel deck, concrete walls, concrete block wall, gypsum board/stud walls, wood flooring/ceiling assemblies.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
03835	RTC350	For 3" (7.6 cm) and 4" (10.2 cm) Trade Size Pipe and Corresponding Couplings	1	6	0.70

SSW INTUMESCENT WRAP STRIPS



When you need a great solution for firestopping insulated and combustible pipe penetrations choose RED2 Wrap Strip. If your project takes you beyond stock PVC and ABS piping and into the tougher-to-protect plastics like PP, FRPP and PVDF, you need the unmatched power and protection of BLU and BLU2 Wrap Strips!

FEATURES & BENEFITS:

The industry's broadest range of UL® Classified systems including the largest tested plastic pipes!

- Easy installation - soft and flexible, less strip and less fasteners needed.
- Rapid expansion - closes off burning penetrants faster.
- High volume char - significant expansion seals off opening!
- Water-resistant - no soluble or hygroscopic ingredients.
- Economical - 12' roll means no piecing…less waste!
- Highly flexible - no foil...soft...supple...easier to install!
- Versatile performer - for a wide range of complex applications.

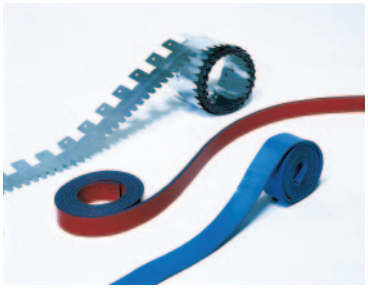
SpecSeal FIRESTOP PRODUCTS

APPLICATIONS

- Firestopping combustible penetrants such as nonmetallic pipes or pipe insulation.
- All common forms of construction - concrete floors, concrete over steel deck, concrete walls, concrete block walls, gypsum board/stud walls, and wood floor/ceiling assemblies.
- Can be used with restraining collars or as a tuck-in.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
03701	SSWBLU	Blue Wrap Strip (2"Wx3/16"Tx12'L)	1	8	2.83
03711	SSWBLU2	Blue Wrap Strip (2"Wx1/8"Tx12'L)	1	8	1.59
03720	SSWBLU220	1/8" Thick x 1.5" W x 8" L - Precut Wrap Strip for 2" Pipe	25	25	1.64
03730	SSWBLU230	1/8" Thick x 3" W x 11-3/16" L - Precut Wrap Strip for 3" Pipe	25	25	4.74
03740	SSWBLU240	1/8" Thick x 4" W x 14-5/8" L - Precut Wrap Strip for 4" Pipe	25	25	7.82
03125	SSW125	1/8" Thick x 1-1/2" W x 8-1/8" L - Precut Wrap Strip for 2" Pipe	25	-	1.38
03250	SSW250	1/4" Thick x 1-1/2" W x 12-1/8" L - Precut Wrap Strip for 3" Pipe	25	-	5.13
03375	SSW375	3/8" Thick x 1-1/2" W x 16-1/8" L - Precut Wrap Strip for 4" Pipe	25	-	8.88
03702	SSWRED	Red Wrap Strip (1.5" W x 1/4" T x 12' L)	1	10	3.03
03712	SSWRED2	Red Wrap Strip (1.5"Wx1/8"Tx12'L)	1	8	1.14
03750	SSWRC	Metal Restraining Collar 25' (For use with SSWBLU)	1	1	5.06
03752	SSWRC2	Metal Restraining Collar 25' (For use with SSWRED)	1	1	3.76
03753	WSC-8	Preformed Restraining Collar for 6" & 8" Plastic Pipe for use with BLU/BLU2	1	1	1.52
03754	WSC-8RED	Preformed Restraining Collar for 6" Plastic Pipe for use with RED/RED2	1	1	1.06
03760	WSC-12	Preformed Restraining Collar for 10" & 12" Plastic Pipe for use with BLU/BLU2	1	1	2.00



FIRESTOP ACCESSORIES

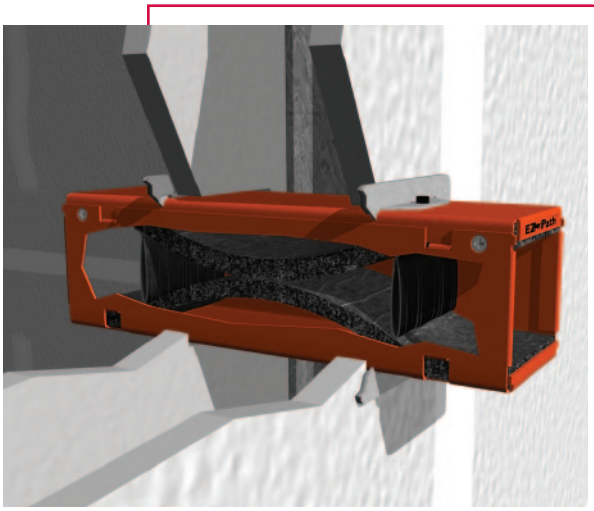
STI has several accessories available for installing firestop. Caulk tubes, mineral wool boards and even warning labels for labeling your barriers.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
05001	SSAMW	Mineral Wool Boards (2) 2'x4'x1.5" Per box (5.08 x 10.16 x 3.81 cm)	1	-	12.00
05020	SSACG	Caulk Gun (11 oz.)	1	4	1.49
05021	SSAQCG	29 oz. Caulk Gun	1	-	2.50
05022	SSASCG	20 oz. Caulk Gun	1	-	2.90
09554	Z1002-892-CG	Firestop Penetration Warning Label (5 3/8" x 4 1/2") (13.65 x 11.43 cm)	1	1000/roll	0.01
03775	SSWFT	Foil Tape 2" x 30'	1	6	0.44

EZ-Path® FIRE RATED PATHWAY

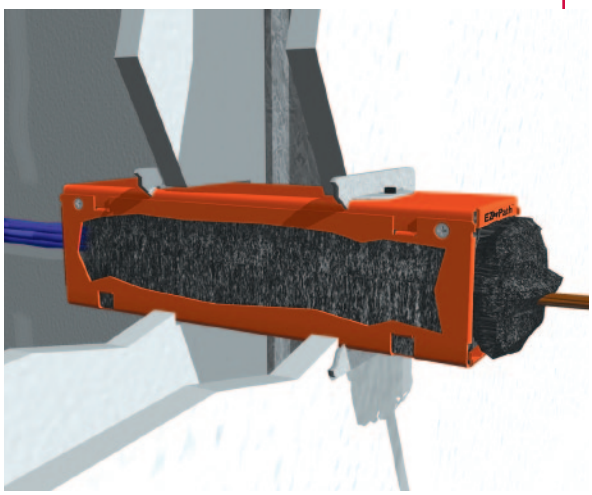
CONTINUOUSLY STOPPING FIRE - WITHOUT CONTINUOUSLY FIRESTOPPING



- Maximum resistance to fire and smoke whether empty or 100% visually filled.
- Assures fire and smoke protection with every new or retrofit cable installation.
- Superior fire and smoke leakage vs. standard sleeve and putty systems.
- Unlike conventional sleeve and putty system, EZ-Path® remains fire and smoke compliant 100% of the time!
- U.S. Patent 6,732,481.

MAXIMUM FIRE AND SMOKE PROTECTION

- Built-in firestopping system automatically adjusts to the number of cables installed — assures it is firestopped — even at maximum cable loading.
- Intumescent material rapidly responds to flames or heat by quickly sealing the pathways and preventing the passage of flames and smoke.
- Excellent F, T & L Ratings.
- Published total leakage area values - no additional putty or pieces to maintain ratings.
- UL® Classified and FM Approved in accordance with ASTM E814 (UL 1479).
- UL systems are available for up to 4 hour rated floor and wall constructions.



SPECIFICATIONS

CLASSIFIED C UL US

FIRESTOP DEVICE FOR USE IN THROUGH-PENETRATION FIRESTOP SYSTEMS. SEE UL DIRECTORY OF PRODUCTS CERTIFIED FOR CANADA AND UL FIRE RESISTANCE DIRECTORY.

FM APPROVED

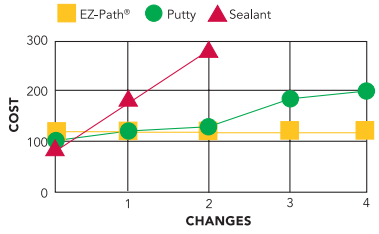
All data, video, and communications cable bundles shall utilize an enclosed fire rated pathway device wherever said cables penetrate rated walls. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to adjust, remove or reinstall firestop materials. The pathway shall be UL® Classified and/or FM Systems Approved and tested to the requirements of ASTM E814 (UL1479).

Specified Divisions

DIV. 7	07 84 00	Penetration Firestopping
DIV. 26	26 00 00	Electrical
DIV. 27	27 00 00	Communications

EZ-Path® FIRE RATED PATHWAY

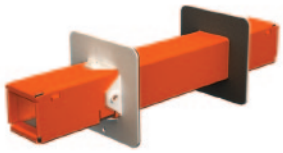
PAYS FOR ITSELF IN A FEW CHANGES... A ZERO MAINTENANCE SOLUTION



When compared to traditional sleeves sealed with sealant or putty, EZ-Path® will have paid for itself in just three cable changes or less. The savings will increase with each additional cable change.

- All-in-one design installs in minutes.
- Conveniently packaged kits for easy installation — no additional parts to order.
- Splits apart for old work.
- Wide range of accessories.
- Group pathways for additional capacity.
- Organizes and manages cables.
- Clean, professional, engineered appearance.
- Easy moves, adds and changes.
- Can be installed as the wall is being built.

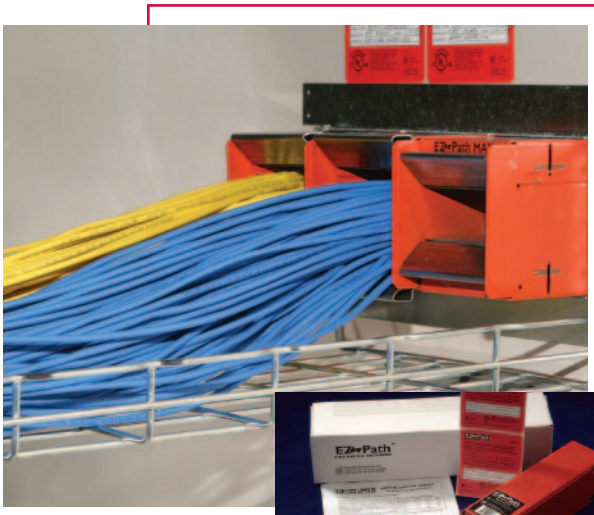
CHOOSE THE RIGHT EZ-PATH® CONFIGURATION FOR YOUR CABLING NEEDS!



	Series 22	Series 33	Series 44
Height x Width Inches (mm)	1.5″ x 1.5″ (38 mm x 38 mm)	3.0″ x 3.0″ (76 mm x 76 mm)	4″ x 4-5/8″ (102 mm x 118 mm)
Length Inches (mm)	10.5″ (267 mm)	10.5″ (267 mm)	14″ (356 mm)
Volume Expansion	40X	16X	16X
Can be Ganged	Up to 3	Up to 7	Up to 5 in walls Up to 16 in floors
Can be Lengthened	--	6″ (152 mm) increments	--
Insert into Cored Hole	2″ (51 mm)	4″ (102 mm)	6″ (153 mm)
Attached to Conduit	--	4″ (102 mm)	--
Fire Rated in Walls	Up to 4 hours	Up to 4 hours	Up to 4 hours
Fire Rated in Floors	--	Up to 4 hours	Up to 4 hours
Approx. Max Cable Capacity	25 ±	120 ±	244 ±
Approx. Max Cable Capacity (Ganged)	75 ±	840 ±	1,220 ±
Approx. Max Cable Capacity (Grid)	--	--	3,904 ± in floors

Cable capacity estimates are based upon using CAT5. Cable diameters vary widely by manufacturer. Consult STI's cable estimator online for accurate estimates.
www.stifirestop.com/ezpath

EZ-Path®
FIRE RATED PATHWAY

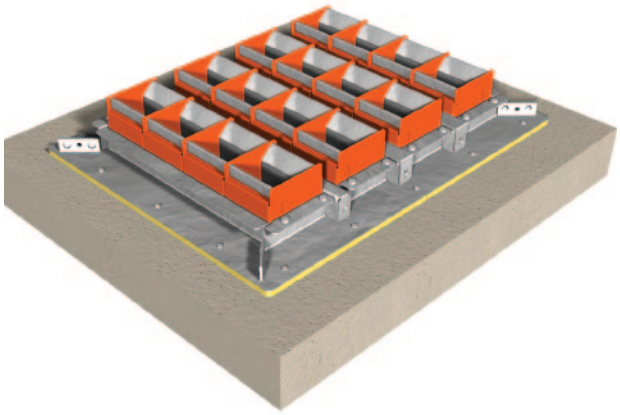


- Organize cables by type, use or trade.
- Install in walls or floors to provide managed portals to route cables.
- Install one or gang them up for additional capacity and better cable organization!

All pathway kits are conveniently packaged with 22, 33, and 44 Series EZ-PATH® Fire Rated Pathways, plates, gaskets and labels for installation!

MODULAR FLOOR GRID SYSTEM

- An EZ-Path® Solution for high volume cable penetrations through floors.
- A bolt-in solution for riser applications that brings the safety and simplicity of EZ-Path® to your vertical cable installations.
- The EZ-Path® Modular Floor Grid System can handle literally thousands of cables.
- Modular Floor Grid Systems utilize the high volume, EZ-Path® 44 Series Pathways installed in banks of four to provide your cabling systems with room to grow.



Sturdy steel grids mount one, two or four banks or pathways in built-in slots for a total of up to sixteen pathways through a single floor opening. A single bank Floor Grid comes complete with pathways. Multi-bank Modular Floor Grids are installed with firestop panels sealing each slot. As additional cable capacity is required, firestop panels are removed and pathway modules containing four pathways are installed in each slot.

For our easy-to-use installation guide on the complete EZ-PATH® Fire Rated Pathway product line, contact STI customer service or download a copy at www.stifirestop.com/literature.

ORDERING INFORMATION

UPC 730573-	CATALOG NUMBER	DESCRIPTION	MIN. QTY/ CASE QTY.
Series 22 EZ-Path® Fire-Rated Pathway Kits*			
00022	EZD22†	Series 22 - Fire-Rated Pathway Kit	6
Series 33 EZ-Path® Fire-Rated Pathway, Kits*, Accessories and Plate Packs**			
00004	EZD33FWS†	Series 33 - Fire-Rated Pathway Device	6
00034	EZDP33FWS	Series 33 - Square Kit - Device with square wall plate pack	4
00035	EZDP133CWK	Series 33 - Circular Kit - Device with circular wall plate pack	1
00005	EZD33E	Series 33 - Extension Module	1
00533	EZDP33WR	Series 33 - Retro-Fit Kit - Device with retro-fit wall plate pack	1
00835	EZDP133FK	Series 33 - Kick in Kit - Device with kick-in plate pack	1
00235	EZDP233GK	Series 33 - Two-Gang Kit - Two (2) Devices with two-gang plate pack	1
00335	EZDP333GK	Series 33 - Three-Gang Kit - Three (3) Devices with three-gang plate pack	1
00435	EZDP433GK	Series 33 - Four-Gang Kit - Four (4) Devices with four-gang plate pack	1
00436	EZDP433GK-C	Series 33 - Color Coded Four-Gang Kit Four (4) Devices (1-orange, 1-blue, 1-yellow, 1-white) with four-gang plate pack	1
00735	EZDP733GK	Series 33 - Seven-Gang Kit - Seven (7) Devices with seven-gang plate pack	1
00036	EZDP133CAK	Series 33 - Conduit Attachment Kit-Device with conduit attachment plate pack	1
00137	EZP133CW	Series 33 - Circular Wall Plate Pack	1
00133	EZP133W	Series 33 - Single Square Wall Plate Pack	1
00233	EZP233W	Series 33 - Double Wall Plate Pack	1
00333	EZP333W	Series 33 - Triple Wall Plate Pack	1
00433	EZP433W	Series 33 - Four-Gang Plate Pack	1
00733	EZP733W	Series 33 - Seven-Gang Plate Pack	1
00135	EZP133PC	Series 33 - One Pair (2) Positioning Clamps	1
00833	EZP133K	Series 33 - Single Kick-In Plate Pack - (For use with floor applications)	6
00535	EZP133R	Series 33 - Retro-Fit Mounting Plate Pack	1
00138	EZP133CA	Series 33 - Conduit Attachment Plate Pack	1
00933	RCM33	Series 33 - One Pair (2) Radius Control Modules	1
Series 44 EZ-Path® Fire-Rated Pathway, Kits*, Grid Assemblies, and Plate Packs**			
00007	EZD44	Series 44 - Fire-Rated Pathway Device	4
00044	EZDP44	Series 44 - Fire-Rated Pathway Kit - Device with single wall plate pack	1
00045	EZDP144FK	Series 44 - Floor Kit - Device with floor plate pack	1
00444	EZDG444	Series 44 - Single Bank Floor Grid - Four (4) Devices with floor frame	1
00048	EZD444MB	Series 44 - Single Bank of Devices - Four (4) Devices with hanger bracket	1
00845	EZDG844	Series 44 - Multi-slot Frame Kit for 8 Pathways - (Includes eight (8) Series 44 devices with EZG844)	1
00645	EZDG1644	Series 44 - Multi-slot Frame Kit for 16 Pathways - (Includes sixteen (16) Series 44 devices with EZG1644)	1
00144	EZP144W	Series 44 - Single Wall Plate Pack	1
00544	EZP544W	Series 44 - Multi-Gang Wall Plate Pack	1
00834	EZP144F	Series 44 - Split Floor Plate Pack	1
00844	EZG844	Series 44 - Multi-Slot Frame for Eight (8) Pathways	1
00644	EZG1644	Series 44 - Multi-Slot Frame for Sixteen (16) Pathways	1

** All Kits include appropriate quantity of pathways, wall plates, gaskets, labels, required set screws and an allen key. **All plate packs include wall plates, gaskets, labels, required set screws and an allen key.*
† Available in custom colors on a special order basis in yellow, blue and white.

FIRESTOP COMPOSITE SHEET

COMPOSITE SHEET

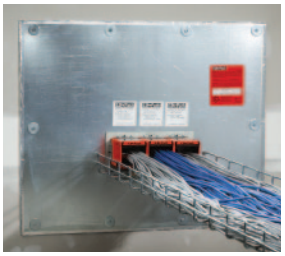
Lightweight, easily fabricated panels surface mount to walls and floors to provide a neat, clean firestop seal for medium to large openings with a variety of penetrants in fire-rated floors and walls.

FEATURES & BENEFITS:

- Lighter and thinner - approximately 1/2 the weight and thickness of traditional composite sheet.
- Easier to fabricate - engineered with the installer in mind.
- Can be cut and installed with common sheet metal tools.
- Intumescent - expands up to 15 times when exposed to temperatures in excess of 350°F (177°C) compared to 8-10 times for competing brands. Forms a dense insulative char that minimizes heat transfer.
- Hole reduction - reduces large openings when used in conjunction with other SpecSeal® or EZ-Path® Firestop Products.
- Tested to ASTM E 814 (ANSI/UL 1479).
- Acoustically tested - reduces sound transmission.

APPLICATIONS

- Medium to large openings through common constructions.
- Single or multiple cable trays for power, voice, data.
- Bus ducts.
- Multiple metallic conduits & tubing. Multiple mixed penetrants of many types.
- Blank Openings (penetrants removed).
- Suitable for clean room/area environment.
- Combine with the EZ-PATH® System for cable penetrations through large openings.
- Plastic pipes.
- Insulated metallic pipes.
- Metal pipes.



ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
11628	CS1628	16 x 28 in. (41 x 71 cm) Composite Sheet	1	2	4.40
12436	CS2436	24 x 36 in. (61 x 92 cm) Composite Sheet	1	2	8.40
13636	CS3636	36 x 36 in. (92 x 92 cm) Composite Sheet	1	2	12.60
14136	CS3641	36 x 41 in. (92 x 104 cm) Composite Sheet	1	2	14.40
15228	CS2852	28 x 52 in. (71 x 132 cm) Composite Sheet	1	2	14.20

FIRESTOP MORTAR

SSM FIRESTOP MORTAR

A Lightweight, Cementitious, Fire-Rated Compound.

SpecSeal® Firestop Mortar is suitable for openings of all sizes. Its method of application makes it specifically useful for medium to large openings through concrete or masonry floors or walls with simple to very complicated combinations of penetrants.

FEATURES & BENEFITS:

- Light weight/low density - less forming and support required. Easy retrofit!
- Fast drying - forms come down faster!
- Economical - highest yield per pound means lower installed cost.
- Wide range of application - includes aluminum cable tray.
- Red color - easy identification and inspection.
- Chemical adhesion - reduces the need for expensive and time-consuming concrete fasteners.
- Trowelable and self-leveling.

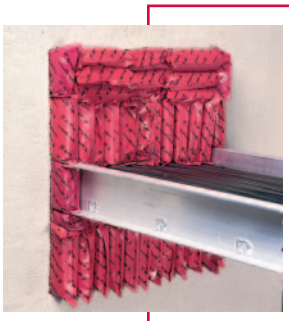
APPLICATIONS

- Large openings through concrete floors and walls.
- Cable trays.
- Bus duct.
- Multiple pipes.
- Insulated pipes.
- Plastic pipes.
- Cables

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
04106	SSM106	Mortar 6 gal. Pail (22 Lbs., 10 Kilos)	1	n/a	24.00
04200	SSM22B	Mortar Bag (22 Lbs., 10 Kilos)	1	n/a	23.00

SSB INTUMESCENT FIRESTOP PILLOWS



Compressible cushions can be easily installed and removed. The perfect firestop solution for medium to large openings including cable bundles, cable trays, bus ducts and multiple conduits.

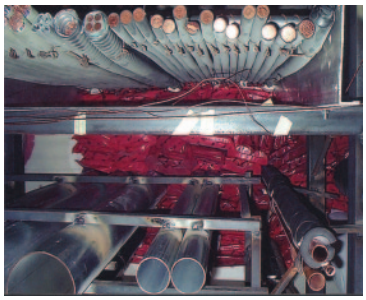
FEATURES & BENEFITS:

- Intumescent - expands in all directions for a tough, tight seal.
- Re-installable for easy retrofitting of cables.
- Single side application makes installation easy for tough access openings.
- Heat-sealed poly cover protects core and makes pillows slide in and out with ease.
- Superior air leakage ratings!
- Broad base of tested systems.
- UL Classified (up to 4 hr.).
- FM Approved.

SpecSeal FIRESTOP PRODUCTS

APPLICATIONS

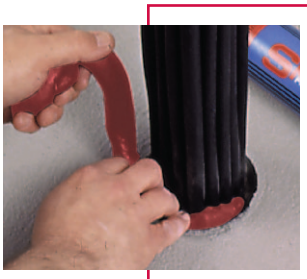
- Medium to large openings through common constructions.
- Loose cable for power, voice, data.
- Single or multiple cable trays for power, voice, data.
- Bus ducts.
- Multiple metallic conduits & tubing.
- Multiple, mixed penetrants of all types.



ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
06140	SSB14	Firestop Pillow 1"x 4"x 9" (2.5 x 10 x 23 cm)	1	20	0.18
06240	SSB24	Firestop Pillow 2"x 4"x 9" (5.0 x 10 x 23 cm)	1	10	0.27
06260	SSB26	Firestop Pillow 2"x 6"x 9" (5.0 x 15 x 23 cm)	1	22	0.35
06360	SSB36	Firestop Pillow 3"x 6"x 9" (7.6 x 15 x 23 cm)	1	16	0.48

SSP INTUMESCENT FIRESTOP PUTTY



Non-hardening, intumescent putty is easily installed and removed making it the perfect choice for cable penetrations requiring occasional retrofitting.

FEATURES & BENEFITS:

- Non-hardening for easy installation and retrofitting of cables.
- Two-stage intumescence provides aggressive expansion.
- Highly adhesive: stays put!
- Unaffected by humidity, condensation, water.
- Soft, pliable, easy to install.
- Tested and proven acoustical properties.
- No tools required.
- UL Classified (up to 3 hr.)
- FM Approved.

SpecSeal FIRESTOP PRODUCTS

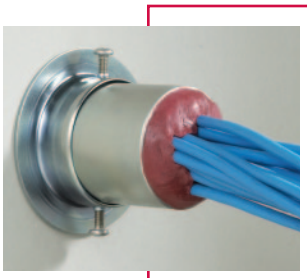
APPLICATIONS

- Small to medium openings through common constructions.
- Single or multiple cables for power, voice, data.
- Single or multiple cable trays for power, voice, data.
- Sleeved openings for cable bundles
- Conduits.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
02100	SSP100	Putty 36 Cu. In. Tube (.6 L)	1	6	2.30
02101	SSP28	Putty 24 Cu. In. Tube (.39 L)	1	1	1.85

READY™ SLEEVE



A complete code compliant firestop sleeve assembly for new cable installations. Includes all mounting hardware and internal and external firestop sealing materials. Available in 1" (33 mm OD), 2" (60 mm OD), and 4" (114 mm OD) sizes with standard or large escutcheon plates.

FEATURES & BENEFITS:

- Complete! Includes sleeve, all mounting hardware, firestopping materials.
- Saves money by reducing expensive shop and field labor.
- Standard and large escutcheons available.
- Meets code requirements for internal/external firestop sealing.
- Meets code requirements for wall attachment.
- Built-in bushings protect cables.*
- Includes SpecSeal® Series SSP Intumescent Firestop Putty sufficient for 1" (25 mm) depth at both ends.
- UL Classified (up to 4 hr.)

* Standard for 2"(60 mm OD) and 4"(114 mm OD) sizes. Separate bushing provided for 1" (25 mm).

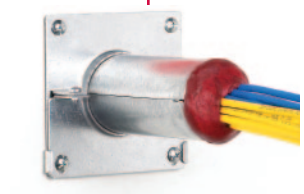
APPLICATIONS

- Protect, support and seal cables routed through rated and non-rated walls & floors.
- All common constructions up to 10" (250 mm) thick.
- Available trade sizes 1" (33 mm OD), 2" (60 mm OD), 4" (114 mm OD).
- Standard small escutcheons for accurate gypsum board openings.
- Large escutcheons for concrete or masonry openings.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
20100	FS100	1" (25 mm) Firestop Sleeve	1	6	1.00
20200	FS200	2" (51 mm) Firestop Sleeve	1	6	2.00
20400	FS400	4" (102 mm) Firestop Sleeve	1	6	4.00
20201	FS201	2" (51 mm) Firestop Sleeve w/ large escutcheon plates	1	n/a	2.90
20401	FS401	4" (102 mm) Firestop Sleeve w/ large escutcheon plates	1	n/a	4.80

READY™ SPLIT SLEEVE



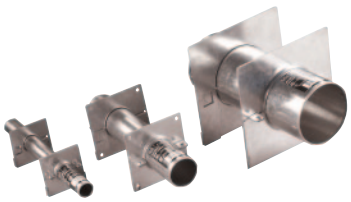
Ready™ Sleeve convenience for existing cable installations. Split sleeve and two-piece wall plates allow sleeve to be assembled around cables and locked into the wall or floor. Available in 1" (33 mm OD), 2" (60 mm OD), and 4" (114 mm OD) sizes.

FEATURES & BENEFITS:

- Complete! Includes split sleeve, all mounting hardware, firestopping materials.
- Over-sized plates for larger or irregular openings.
- Built-in bushings protect cables.
- Meets code requirements for internal/external firestop sealing.
- Optional wall attachment points provided for sleeve stabilization.
- Includes SpecSeal® Firestop Putty as well as split external firestop gasket.
- UL Classified (up to 4 hr).

APPLICATIONS

- New or existing cable installations through walls or floors.
- All common constructions up to 10" (250 mm) thick.
- Available trade sizes 1" (33 mm OD), 2" (60 mm OD), 4" (114 mm OD).
- Oversized or irregular openings.



ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
21000	FSR100	1" (25 mm) Split Firestop Sleeve	1	4	1.25
22000	FSR200	2" (51 mm) Split Firestop Sleeve	1	4	2.50
24000	FSR400	4" (102 mm) Split Firestop Sleeve	1	4	6.25

POWERSHIELD™ ELECTRICAL BOX INSERTS

When used within metallic switch and receptacle boxes, inserts are UL Tested and Classified to permit larger boxes and reduced spacing.

FEATURES & BENEFITS:

- Easy installation! Just peel and stick to inside of box.
- Can be installed before or after wall is closed.
- Non-conductive liner face.
- Easy retrofit installation.
- Low profile for minimum impact on box volume.
- Tested and proven acoustical properties.
- One step installation saves time and labor.

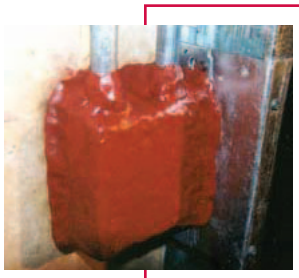
APPLICATIONS

- Single & multi-gang metallic boxes up to 14" (356 mm) long.
- A variety of non-metallic boxes.
- Plastic & steel faceplates.
- 1& 2 hr. wood or steel stud walls.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
02500	EP44	Electrical Box Insert 3 3/4" x 3 3/4" x 1/8" pad	1	20	0.09
02505	EP45	Electrical Box Insert 4-1/4" x 4-1/4" x 1/8" pad	1	20	0.10

SSP INTUMESCENT PUTTY PADS



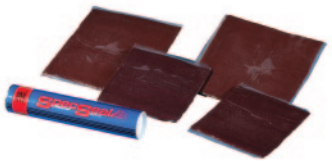
Externally applied to switch and receptacle boxes, pads are UL tested and Classified to permit larger boxes and reduced spacing in gypsum board walls.

FEATURES & BENEFITS:

- Fits common 4S box with no cutting or trimming.
- Two-Stage intumescence provides aggressive expansion.
- Highly adhesive: stays put.
- Unaffected by humidity, condensation, water.
- Soft, pliable, easy to install.
- Tested and proven acoustical properties.
- Poly liner allows hands-off, clean installation.

APPLICATIONS

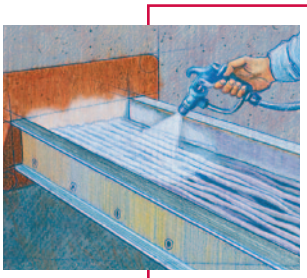
- Single & multi-gang metallic boxes up to 14" (356 mm) long.
- A variety of non-metallic boxes.
- Plastic & steel faceplates.
- 1& 2 hr. wood or steel stud walls.



ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
02200	SSP4S	Putty Pad 7.25" x 7.25" x 3/16"	1	20	0.59
02300	SSP9S	Putty Pad 9.00" x 9.00" x 3/16"	1	20	0.99

CABLE SPRAY



Water-based, spray-applied coating used to provide short term circuit integrity and improved flame spread characteristics for grouped electrical cables.

FEATURES & BENEFITS:

- Easy and economical to use.
- Water-based - easy cleanup, installation and disposal.
- Low friction formula - Less pump wear.
- Brushable for touch ups and spot repairs.

APPLICATIONS

- Encapsulate grouped cables.
- Apply as fire breaks in cable tray runs.

ORDERING INFORMATION

UPC #	Part #	Description	Qty.	Case Qty.	Weight Each - lbs.
07104	CS105	Cable Spray 5 gal. (1,155 Cu.In., 19.0 L) Pail	1	n/a	55.00

Distributed By:

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ZSTI 3113 Rev: 10/2009

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Sections:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:

1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:

a. Fire-resistive joint system products bear classification marking of qualified testing agency.
b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

C. Special Inspections: Allow for 1 of each type of firestopping system to be removed and inspected for conformance with approved submittals. All firestopping shall be inspected prior to the installation of ceilings.

D. Above Ceiling review: Prior to the installation of ceilings, a review of construction completion shall be conducted for firestopping and other items that will not be visible when the ceilings have been installed.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Grace Construction Products.
    b. Hilti, Inc.
    c. Nelson Firestop Products.
    d. RectorSeal Corporation.
    e. Specified Technologies Inc.
    f. 3M Fire Protection Products.
    g. Tremco, Inc.; Tremco Fire Protection Systems Group.
    h. USG Corporation.

C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg or ASTM E 2307.

1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Grace Construction Products.
    b. Hilti, Inc.
    c. Nelson Firestop Products.
    d. RectorSeal Corporation.
    e. Specified Technologies Inc.
    f. 3M Fire Protection Products.
    g. Thermafiber, Inc.
    h. Tremco, Inc.; Tremco Fire Protection Systems Group.
    i. USG Corporation.

D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Grace Construction Products.
    b. Hilti, Inc.
    c. Nelson Firestop Products.
    d. RectorSeal Corporation.
    e. Specified Technologies Inc.
    f. 3M Fire Protection Products.
    g. Tremco, Inc.; Tremco Fire Protection Systems Group.
    h. USG Corporation.

E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

F. VOC Content: Fire-resistive joint system sealants shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

B. Do not install identification on exposed finished wall locations.

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

D. Reinstall firestopping materials that have been removed for inspection.

3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Latex joint sealants.

B. Related Sections:

1. Section 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Section 079500 "Expansion Control" for building expansion joints.
3. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
4. Section 088000 "Glazing" for glazing sealants.
5. Section 092900 "Gypsum Board" for sealing perimeter joints.
6. Section 093000 "Tiling" for sealing tile joints.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Sealant Type 1: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Dow Corning Corporation; 790 (VOC 43); 756 SMS (VOC 87) for cold applications.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Pecora Corporation; 890 (VOC na).
d. Sika Corporation, Construction Products Division; SikaSil-C990.
e. Tremco Incorporated; Spectrem 1 (VOC 1).

B. Sealant Type 2: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

2. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 756 SMS (VOC 87).
    b. GE Advanced Materials - Silicones; SilPruf LM SCS2700 (VOC 27).
    c. Pecora Corporation; 890NST (VOC 98).

C. Sealant Type 3: Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant; ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation; 790 (VOC 43).
    b. Pecora Corporation; 301 NS (VOC 50).
    c. Tremco Incorporated; Spectrem 800 (VOC 1).

D. Sealant Type 4: Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation; 786(VOC 33) (Food)
    b. GE Advanced Materials - Silicones; Sanitary SCS1700.
    c. Tremco Incorporated; Tremsil 200 Sanitary (VOC 1).

E. Sealant Type 5: Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that, when cured and washed, meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.
2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation; 786(VOC 33).
    b. Kason; 3700 Series Rubbaseal Silicone Sealant.
    c. C. R. Larence Co.; CRL 33S Silicone (VOC 39).

2.3 LATEX JOINT SEALANTS

A. Sealant Type 6: Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. BASF Building Systems; Sonolac (VOC 41).
    b. Bostik, Inc.; Chem-Calk 600.
    c. Pecora Corporation; AC-20 (VOC 31).
    d. Tremco Incorporated; Tremflex 834.

2.4 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing

optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

a. Concrete.
b. Masonry.
c. Unglazed surfaces of ceramic tile.
d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.
b. Glass.
c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Exterior Isolation and Contraction Joints in Cast-in-place Concrete Slabs or Joints in Stone Paving Units.

1. Silicone Joint Sealant: Sealant Type 3.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Exterior Control, Expansion, and Soft Joints in Masonry and Between Masonry and Adjacent Work.

1. Silicone Joint Sealant: Sealant Type 1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Exterior Control, Expansion, and Soft Joints Between Masonry and Metal Door Frames, Windows, Storefronts and Curtain Walls.

1. Silicone Joint Sealant: Sealant Type 1.

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Exterior Control, Expansion, and Soft Joints in Stone Work and Between Stone and Adjacent Work.

1. Silicone Joint Sealant: Sealant Type 2.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Under Exterior Door Thresholds.

1. Silicone Joint Sealant: Sealant Type 1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Exterior Joints for Which No Other Sealant Type is Indicated.

1. Silicone Joint Sealant: Sealant Type 1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Interior Isolation and Contraction Joints in Cast-In-Place Concrete Slabs.

1. Silicone Joint Sealant: Sealant Type 3.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

H. Concealed Interior Perimeter Joints of Exterior Openings.

1. Silicone Joint Sealant: Sealant Type 1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

I. Exposed Interior Perimeter Joints of Exterior Openings.

1. Silicone Joint Sealant: Sealant Type 1.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

J. Perimeter Joints Between Interior Wall Surfaces and Frames of Interior Doors, Windows and Elevator Entrances.

1. Latex Joint Sealant: Sealant Type 6.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

K. Vertical Joints on Exposed Surfaces of Interior Unit Masonry or Concrete Walls and Partitions.

1. Latex Joint Sealant: Sealant Type 6.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

L. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls.

1. Silicone Joint Sealant: Sealant Type 4.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

M. Interior Joints in Food Service Areas.

1. Silicone Joint Sealant: Sealant Type 5.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

N. Interior Joints for Which No Other Sealant is Indicated.

1. Latex Joint Sealant: Sealant Type 6.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review tie-in to air barrier system.

1.6 ACTION SUBMITTALS

A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Standard Steel Doors and Frames:

a. Ceco Door Products; an Assa Abloy Group company.
b. Curries Company.
c. Steelcraft; a division of Ingersoll-Rand.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch, unless metallic-coated sheet is indicated.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inchunless metallic-coated sheet is indicated.
b. Construction: Face welded.

4. Exposed Finish: Factory primed.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
d. Edge Construction: Model 2, Seamless.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
b. Construction: Face welded.

4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Not applicable.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 metallic coating.

1. Wipe Coat Galvanneal materials will not be considered acceptable.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection ratings indicated.
3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
7. Full hinge cut-outs for non-handed doors will not be acceptable.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

    c. Compression Type: Not applicable.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

C. At exterior walls and masonry walls, coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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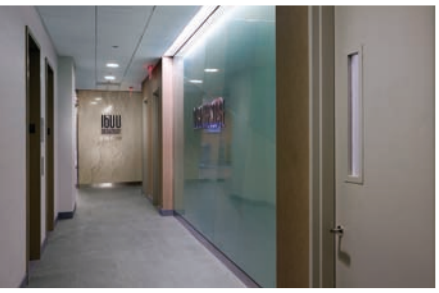

CURRIES Family of Products

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in door opening solutions

Door Details

Steel Stiffened

CURRIES steel stiffened doors are designed with the combination of perimeter steel channels and core stiffeners to offer the industry's largest selection and most reliable and durable construction. They are used in areas where optimum security and susceptibility to vandalism or break-in are of paramount concern. Face sheets are available in gauges from 18 to 14, with door thicknesses of both 1-3/4" (44) and 2" (51). CURRIES 747, 757, 777, 847, and 857 Series doors offer a range of products suited for commercial security uses. Trio™, one of the latest innovations from CURRIES, is a fusion of composite and steel stiffened core to create a new patent pending laminated core. Trio contains all of the aesthetic and insulating benefits of a CURRIES Polyurethane door but with the added strength of being steel stiffened .

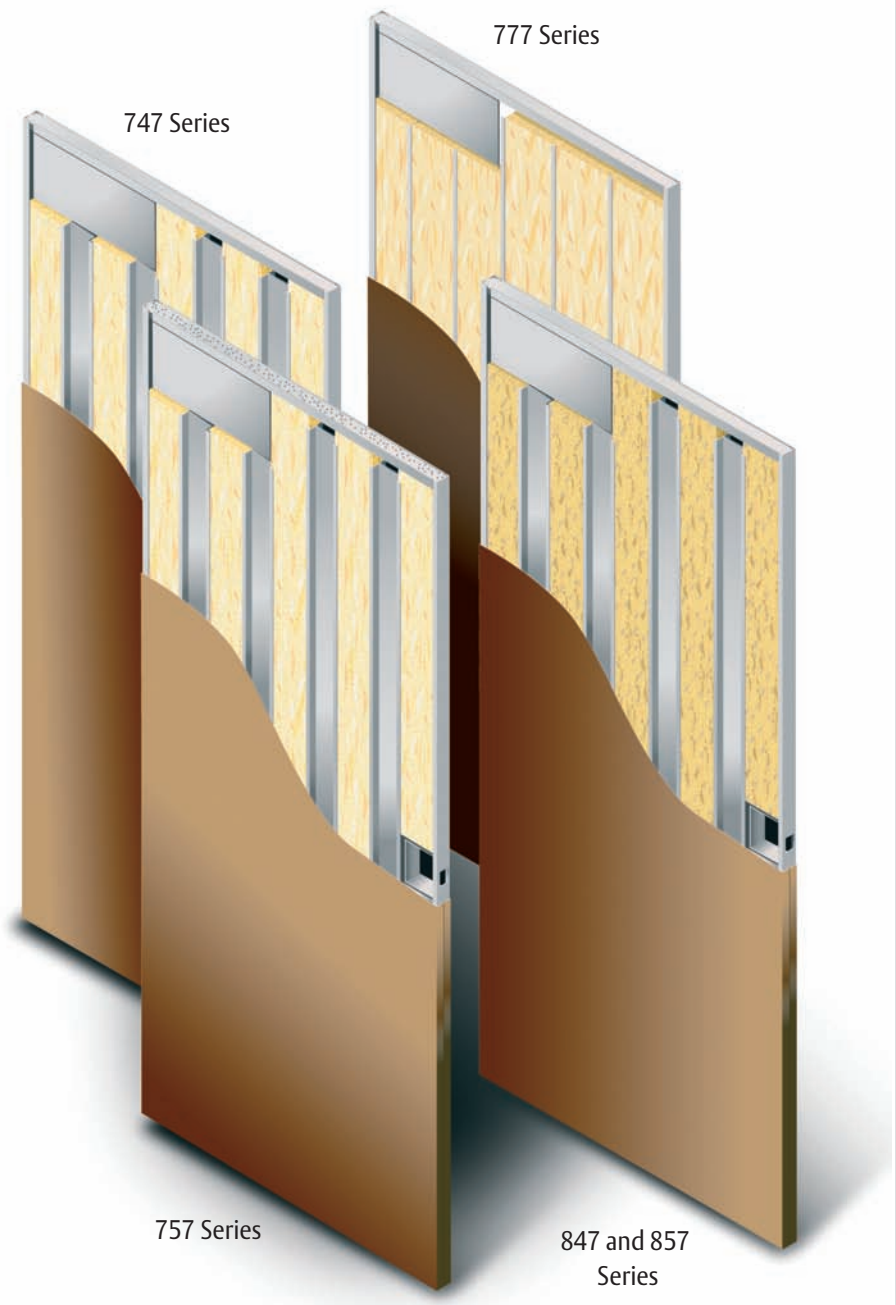
747 Series
- Steel Stiffened
- 16 Gauge Top & Bottom Channels
- 1-3/4 Inches Thick
- 22 Gauge Stiffeners (20, 18, 16, 14 gauge optional)
- Fiberglass Insulation between Stiffeners
- 18, 16 or 14 Gauge Face Skins
- 6" Stiffener Spacing
- Fire Rated up to 3 Hours
- Sizes from 2068 to 50100
- Rugged Perimeter Channel Construction

757 Series
- STC 38, 41, 41 for pairs, 43 & 46 Rated - Steel Stiffened Core
- STC 32 - Honeycomb Core
- 1-3/4 Inches Thick
- 16 Gauge Top & Bottom Channels
- Fiberglass Insulated between Stiffeners
- 6" Stiffener Spacing
- 14 or 16 Gauge Face Skins
- Fire Rated up to 90 Minutes
- Sizes from 2068 to 4080

777 Series
- Steel Stiffened Laminated Core
- Standard Polyurethane Insulation
- Optional Fiberglass Insulation
- 16 Gauge Top & Bottom Channels
- 1-3/4 Inches Thick
- 22 Gauge Stiffeners
- 18, 16 or 14 Gauge Face Skins
- 5" Stiffener Spacing
- Fire Rated up to 3 Hours
- Sizes from 2068 to 4080
- Interlock Seam Construction

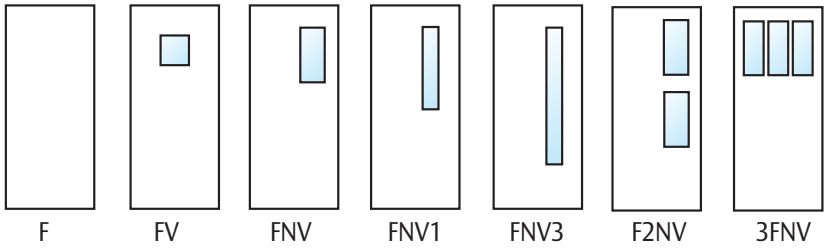
847 Series
- Meets Commercial Security Specifications
- Steel Stiffened Core
- 1-3/4 Inches Thick
- 18 Gauge stiffeners (16 gauge optional)
- 16 Gauge Top & Bottom Channels
- Fiberglass Insulated Between Stiffeners
- 4" Stiffener Spacing
- 14 Gauge Face Skins
- Fire Rated up to 3 Hours
- Sizes from 2068 to 50100
- Rugged Perimeter Channel Construction

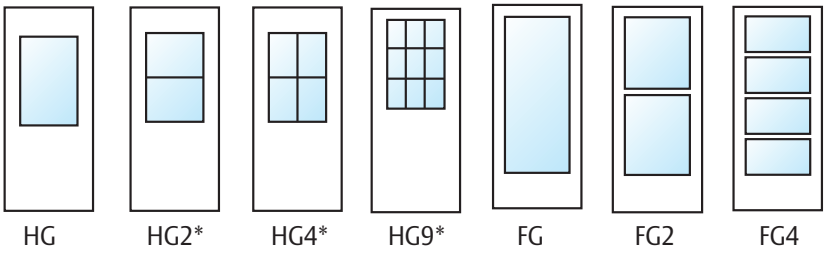
857 Series
- Meets Commercial Security Specifications
- 2 Inches Thick
- 18 Gauge stiffeners (16 gauge optional)
- Steel Stiffened Core
- 14 Gauge / Plus Flush Prep or 16 Gauge Top Channel
- 14 Gauge Bottom Channel
- Fiberglass Insulated Between Stiffeners
- 4" Stiffener Spacing
- 14 Gauge Face Skins
- Fire Rated up to 3 Hours
- Sizes from 2068 to 4080
- Rugged Perimeter Channel Construction

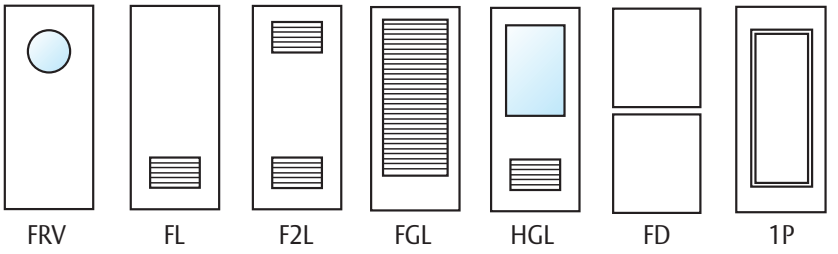


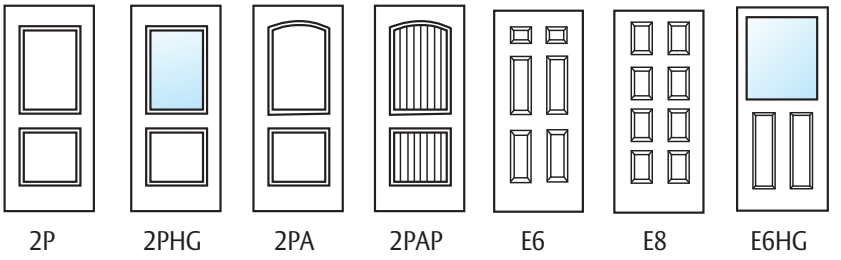
Door Details

Door Selection Faces









*1/4" (6) glass only.

2PA

2PAP

Frame Details

Masonry Flush Frames

CURRIES offers a complete line of flush frames that are available in 18, 16, 14, and 12 gauge cold-rolled or galvannealed steel and also in 16 or 14 gauge stainless steel. Frames can be knocked down or welded at the miters and ground smooth. The 12 gauge frames are saw miter welded or butt end welded corner construction only. They are available for either 1-3/8" (35) or 1-3/4" (44) thick doors. CURRIES frames are manufactured for all wall conditions such as masonry, steel stud, wood stud, and poured concrete.

Frame Face Variables

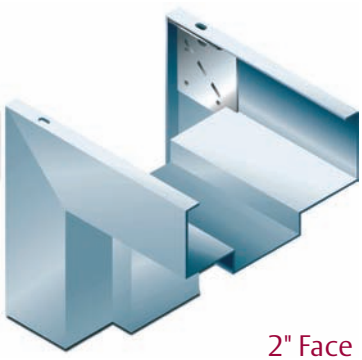
- CURRIES offers pre-engineered, knock-down (KD) flush frames with face dimensions of 1" (25) through 4" (102) in 1/8" (3) increments
- Frame return variables from 7/16" (11) through 1" (25)
- Non-door rabbet variables from 5/8" (16) through 6" (152)
- Standard and non-standard frame sizes are available to match door sizes in any combination of singles or pairs

Overview

Specifications

The frames are manufactured by CURRIES in Mason City, Iowa. They need to be M Series and fabricated of either cold-rolled or galvannealed steel (as specified) in 18, 16, or 14 gauge. The joints need to be die-mitered with integral tabs for reinforcement and interlocking of the jambs to the head. The 12 gauge frames are saw miter or butt end corner construction and shall be welded. Frames shall be thoroughly cleaned and receive an iron phosphate treatment prior to receiving one coat of baked-on prime paint. Frames are to be reinforced only for surface mounted hardware, and the drilling and tapping to be done by others in the field. Metal plaster guards are to be provided for all mortise cutouts. Minimum requirements for hardware reinforcements are to be as follows:

Hinge Reinforcing-7 gauge
Lock Strike Reinforcing-14 gauge and conforming to template requirements
Closer reinforcing-14 gauge



2" Face

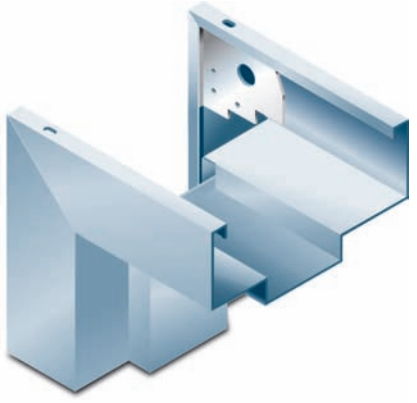
4" Face

Frame Details

Drywall Frames

CURRIES Drywall frames are available in 18, 16, or 14 gauge cold-rolled steel or galvanized steel. The frames are constructed with a rigid corner providing clean, sharp lines along with fine miter lines on all joints. They are designed to go into an opening after the wall is in place, accommodating virtually any wall thickness. Frames receive a factory baked-on coat of rust inhibitive primer but are also available with factory baked-on enamel. The color match is available upon request. The frames can be used in drywall construction using steel studs, wood studs, or laminated boards. Frames are available for either 1-3/8" (35) or 1-3/4" (44) thick doors with a 2" (51) face.

- Narrow Face Frames: CURRIES offers pre-engineered, knock-down (KD) drywall frames with face dimensions of 1-1/2" (38) or 1-3/4" (44).
- Frame sizes are available to match door sizes in any combination of singles or pairs. Non-standard width or height frames are available on special order. Double-rabbet profiles are available with 4" (102) face heads.



C Series Drywall Frames

Specifications

The frames are manufactured by CURRIES in Mason City, Iowa. The frames shall be C Series and fabricated of either cold rolled or galvannealed steel (as specified) in 18, 16, or 14 gauge. Frames shall be knockdown and double return back bend (to prevent cutting into the wall), flush hairline seam miter at the corner of the head and the jamb, and the corner reinforced with a concealed clip. Each jamb is to have one compression anchor to securely hold the frame between the studs and also maintain proper alignment. Frames shall be thoroughly cleaned and receive an iron phosphate treatment prior to receiving one coat of baked-on prime paint. Frames are to be reinforced only for surface mounted hardware, with drilling and tapping to be done by others in the field. Minimum requirements for hardware reinforcements are to be follows:

Hinge Reinforcing-7 gauge
Lock Strike Reinforcing-14 gauge, conforming to template requirements
Closer reinforcing-14 gauge.

CM Series Frames

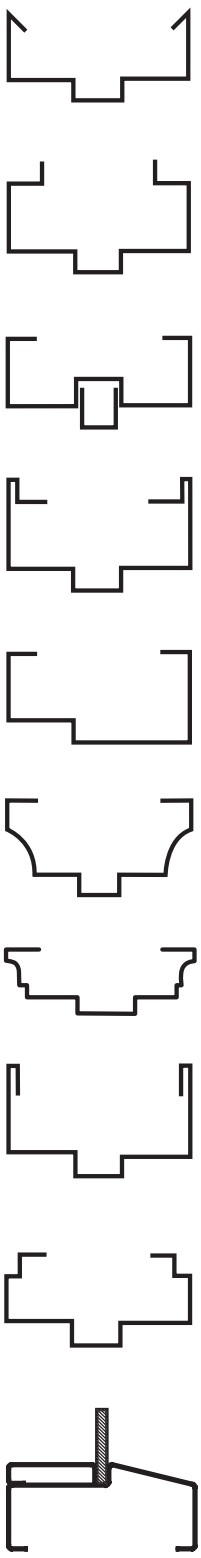
Specifications

The frames are manufactured by CURRIES in Mason City, Iowa. The frames shall be CM Series and fabricated of either cold rolled or galvannealed steel (as specified) in either 18, 16, or 14 gauge. Frames shall be welded corner construction and double return back bend (to prevent cutting into the wallboard). Frames are available with standard anchors and no compression anchor. Frames shall be thoroughly cleaned and receive an iron phosphate treatment prior to receiving one coat of baked-on prime paint. Frames are to be reinforced only for surface mounted hardware, with drilling and tapping to be done by others in the field. Metal plaster guards are to be provided for all mortise cutouts. Minimum requirements for hardware reinforcements are to be as follows:

Hinge Reinforcing-7 gauge
Lock Strike Reinforcing-14 gauge, conforming to template requirements
Closer reinforcing-14 gauge.

Frame Details

Custom Profiles



Specialty Frames

Custom Frames

Combinations or modifications of designs shown are available to meet job requirements. Frames are available in cold-rolled steel, galvannealed, or stainless steel. Jamb depths, face dimensions, stop height, and return length can vary with the job requirements. Frames are fully saw mitered and welded. Custom frame material is welded locally by our distributors, thereby eliminating costly delays and damage in shipment.

Specifications:

Hollow metal frames for all openings shown on the architect's drawings shall be manufactured by CURRIES of Mason City, Iowa. Frames are to be fabricated of either cold-rolled steel or galvannealed steel (as specified) in 18, 16, 14, or 12 gauge. Joints are to be full saw mitered, full welded, and finished to a smooth surface. Frames are to be thoroughly degreased, cleaned, and phosphatized prior to painting with an inhibitive primer. Frames are to be mortised, reinforced, and drilled and tapped for all mortise finish hardware. Frames are to be reinforced only for surface mounted hardware, with drilling and tapping to be done by the installing contractor in the field. Steel plates and mortising boxes are to be welded to all hinge and lock reinforcement.

Lead Lined Frames

Lead lining is furnished by the X-ray contractor. Frames will be provided with clips to retain lead and need to be installed by others. When used with lead-lined doors, it ensures complete X-ray protection. When specified, struts welded to the jambs and extended to the slab above provide more rigid anchorage.

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NAAMM National Association of Architectural Metal Manufacturers

Habitat for Humanity®

CPS - 2/11

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.
4. Factory glazing of wood doors.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.3 ACTION SUBMITTALS

A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.

B. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

D. Samples for Initial Selection: For factory-finished doors.

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish**.** For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Finish colors for metal louvers and light frames.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Algoma Hardwoods Inc.
b. Eggers Industries; Architectural Door Division.
c. Marshfield Door Systems, Inc.: Signature Series.
d. Mohawk Flush Doors, Inc.
e. VT Industries Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 and UL 10C.

1. Include all requirements as part of the door construction per Category “A” guidelines.”
2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors asneeded to eliminate through-bolting hardware.

F. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

2. Provide doors with structural-composite-lumber cores instead of particleboard cores for the following doors:

a. Doors indicated to receive exit devices.
b. Doors where oversized glass lites exceed more than 40 percent of the door surface area.
c. Doors where louvers exceed more than 40 percent of the door surface area.

G. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated asneeded to eliminate through-bolting hardware.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

    a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.
2. Species and Cut in General Area: Select white maple, quarter sawn.
3. Species and Cut in Suites, Office Area and Home Team Locker Room: Select white birch, rotary cut.
4. Match between Veneer Leaves: Slip match for maple, book match for birch.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical Edges: Same species as faces - edge Type A.
8. Core: Particleboard except where structural composite lumber is required.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

C. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Louvers Inc.
    b. Anemostat; a Mestek company.
    c. L & L Louvers, Inc.
    d. LL Building Products, Inc.; a division of GAF Materials Corporation.
    e. Louvers & Dampers, Inc.; a Mestek company.
    f. McGill Architectural Products.

2. Blade Type: Vision-proof, inverted V.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish.

D. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Louvers Inc.
b. Anemostat; a Mestek company.
c. L & L Louvers, Inc.
d. LL Building Products, Inc.; a division of GAF Materials Corporation.
e. Louvers & Dampers, Inc.; a Mestek company.
f. McGill Architectural Products.

2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-4 conversion varnish or TR-6 catalyzed polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

Marshfield® DOORSYSTEMS

SIGNATURE SERIES™

Extra Heavy Duty Particleboard Core Doors

Neutral Pressure, Positive Pressure, Environmental

Standard Models: EHDPC, EHDFP
Environmental Models: EEHDPC, EEHDPCUF

Product Features and Specifications	Interior use only
Thickness	1-3/4", 2", 2-1/4"

Maximum Size

	ITS-WH and UL- Max 20 minute				
	Non Rated	NP	Cat. A (PP)	Cat. A (PPAF)	Cat. B (PPFM)
Single	4/0x10/0	4/0x10/0	4/0x10/0	4/0x9/0	4/0x10/0
Pair	8/0x10/0	8/0x10/0	8/0x9/0	8/0x9/0	8/0x9/0
DE Pair	8/0x10/0	8/0x8/0	8/0x9/0	NA	8/0x9/0

Minimum Size	0/8x1/10 or 1/10x0/8
Surface Material	•Wood Veneers •Medium Density Overlay
Crossbands	One Piece High Density Fiberboard (HDF)
Vertical Edges*	Manufacturer's standard construction is 1" structural composite lumber with veneer edge band. 1 3/8" stiles (3/4" hdwd, 5/8" SCL) available upon request 1 3/8" SCL stiles with veneer edge band available upon request Impact resistant edges available upon request
Horizontal Edges*	Manufacturer's standard construction is 7/8" structural composite lumber. Wider rails available upon request
Face & Core Assembly Adhesive	Per requirements of WDMA I.S. 1A, C-6
Core	Particleboard core (which complies with ANSI A208.1) See WDMA Performance Level below.
Lite Openings	See Appendix I
Factory Finish	•Enviroclad UV® cured polyurethane. Meets WDMA TR-6 and AWS System 9. •Prime •Opaque
Warranty	Full; life of original installation. No exterior warranty
Security Rating	Class 40, highest security rating possible per UBC standard 41-1 & ASTM F-476 section 18
Acoustic Rating	See Appendix M
Environmental Options & LEED Credit Contribution (Not all credits may be available with some constructions)	•MR 4-Recycled Content- all models •MR 5-Regional Materials- all models (Project must be within 500 miles of Marshfield,WI) •MR 6-Rapidly Renewable Materials- all models with Bamboo veneer •MR 7-Certified Wood- EEHDPC & EEHDPCUF •IEQ 4.4-Low-Emitting Materials- all UF models No Added Urea Formaldehyde Resins
Quality Standards (Quality Assurance/ Industry Standards)	Aesthetic: WDMA I.S.1A Architectural Wood Flush Doors (Standard construction) *Other association aesthetic standards upon request WDMA Performance Duty Level: Extra Heavy Duty *Product does not require blocking for surface hardware

Note: Marshfield DoorSystems® doors are manufactured per the standards listed on this page. Specifications are subject to change without notice.
*Note: Fire-Rated doors will be constructed per label service listing and may deviate from above.

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Marshfield® DOORSYSTEMS

SIGNATURE SERIES™

Structural Composite Lumber Core Doors

Neutral Pressure, Positive Pressure, Environmental

Standard Models: DCL
Environmental Models: EDCL, EDCLUF

Product Features and Specifications	Interior use only
Thickness	1-3/4"

Maximum Size

	ITS-WH and UL- Max 20 minute				
	Non Rated	NP	Cat. A (PP)	Cat. A (PPAF)	Cat. B (PPFM)
Single	4/0x10/0	4/0x10/0	4/0x10/0	4/0x10/0	4/0x10/0
Pair	8/0x10/0	8/0x10/0	8/0x9/0	8/0x9/0	8/0x9/0
DE Pair	8/0x10/0	8/0x8/0	8/0x9/0	8/0x9/0	8/0x9/0

Minimum Size	0/8x1/10 or 1/10x0/8
Surface Material	•Wood Veneers •Medium Density Overlay
Crossbands	One Piece High Density Fiberboard (HDF)
Vertical Edges*	Manufacturer's standard construction is 1" structural composite lumber with veneer edge band. 1 3/8" stiles (3/4" hdwd, 5/8" SCL) available upon request 1 3/8" SCL stiles with veneer edge band available upon request Impact resistant edges available upon request
Face & Core Assembly Adhesive	Per requirements of WDMA I.S. 1A, C-6
Core	Structural Composite Lumber (SCL). See WDMA Performance Level below.
Lite Openings	See Appendix I
Minimum Distance from Adjacent Lock and Lite Cutous	1-1/4"
Factory Finish	•Enviroclad UV® cured polyurethane. Meets WDMA TR-6 and AWS System 9. •Prime •Opaque
Warranty	Full; life of original installation. No exterior warranty
Security Rating	Class 40, highest security rating possible per UBC standard 41-1 & ASTM F-476 section 18
Acoustic Rating	See Appendix M
Environmental Options & LEED Credit Contribution (Not all credits may be available with some constructions)	•MR 4-Recycled Content- all models •MR 6-Rapidly Renewable Materials- all models with Bamboo veneer •MR 7-Certified Wood- Contact Sales Center •IEQ 4.4-Low-Emitting Materials- all UF models No Added Urea Formaldehyde Resins
Quality Standards (Quality Assurance/ Industry Standards)	Aesthetic: WDMA I.S.1A Architectural Wood Flush Doors (Standard construction) *Other association aesthetic standards upon request WDMA Performance Duty Level: Extra Heavy Duty *Product does not require blocking for surface hardware

Note: Marshfield DoorSystems® doors are manufactured per the standards listed on this page. Specifications are subject to change without notice.
*Note: Fire-Rated doors will be constructed per label service listing and may deviate from above.

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Marshfield® DOORSYSTEMS

SIGNATURE SERIES™

Fire-Resistant Composite Core Doors: 45-90 Minute

Neutral Pressure, Positive Pressure, Environmental

Standard Models: DFP, DFM
Environmental Models: EDFPUF 45PP, EDFMUF

Product Features and Specifications	Interior use only
Thickness	1-3/4”

Maximum Size

	ITS-WH and UL		
	NP	Cat. A (PP)	Cat. B (PPFM)
Single	4/0x10/0	4/0x10/0	4/0x10/0
Pair	8/0x10/0	8/0x9/0	8/0x9/0
DE Pair	8/0x8/0 (45 min. only)	8/0x9/0	8/0x9/0

Minimum Size	0/8x1/10 or 1/10x0/8
Surface Material	•Wood Veneers •Medium Density Overlay •Primed Hardboard
Crossbands	One Piece High Density Fiberboard (HDF)
Vertical Edges*	Manufacturer’s standard construction per label service listing with edge band to match face. Impact resistant edges available upon request.
Horizontal Edges*	Manufacturer’s standard construction per label service listing.
Face & Core Assembly Adhesive	Per requirements of WDMA I.S. 1A, C-6
Core	Fire-resistant composite per label service listing.
Lite Openings	See Appendix I
Factory Finish	•Enviroclad UV® finish. Meets WDMA TR-6 and AWS System 9. •Prime •Opaque
Warranty	Full; life of original installation. No exterior warranty
Security Rating	Mineral Core- class 30 per UBC standard 41-1 and ASTM F-476 Section 18 Particleboard Core- Class 40 per UBC standard 41-1 and ASTM F - 476 Section 18
Acoustic Rating	See Appendix M
Environmental Options & LEED Credit Contribution (Not all credits may be available with some constructions)	•MR 4-Recycled Content- all models •MR 5-Regional Materials- DFP, EDFPUF models (Project must be within 500 miles of Marshfield, WI) •MR 6-Rapidly Renewable Materials- all models with Bamboo veneer •MR 7-Certified Wood- Contact Sales •IEQ 4.4-Low-Emitting Materials- all UF models No Added Urea Formaldehyde Resins
Quality Standards (Quality Assurance/ Industry Standards)	Aesthetic: WDMA I.S.1A Architectural Wood Flush Doors (Standard construction) *Other association aesthetic standards upon request WDMA Performance Duty Level *Particle Core: Extra Heavy Duty *Mineral Core without Blocking - Below Standard *Mineral Core with Blocking - Extra Heavy Duty (Blocking for mineral core doors provided upon request)

Note: Marshfield DoorSystems® doors are manufactured per the standards listed on this page. Specifications are subject to change without notice.

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

1.3 ALLOWANCES

A. Access doors and frames are part of an access door and frame allowance.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products, Inc.
2. Babcock-Davis.
3. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
4. Karp Associates, Inc.
5. Larsen's Manufacturing Company.

6. Milcor Inc.
7. Nystrom, Inc.
8. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Concealed Flanges:

1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
2. Locations: Ceiling.
3. Door Size: As indicated on the drawings.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.

a. Finish: Factory prime.

5. Frame Material: Same material and thickness as door.
6. Hinges: Manufacturer's standard.
7. Hardware: Latch.

D. Hardware:

1. Latch: Cam latch operated by screwdriver.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

DETAIL & SUBMITTAL SHEET

WALLS & CEILINGS

SPECIFICATIONS:

Door: 14 ga. steel

Frame: 16 ga. steel. These models have a 1" wide perforated flange of 24 ga. galvanized steel for mounting purposes

Hinge: Full length piano hinge on 6 x 6 and 8 x 8. Full length piano hinge also on 24 x 36 and larger. Concealed hinge on sizes 10 x 10 to 24 x 24

Latches: Flush, stainless steel cam latch

Finish: Grey baked enamel coat

OPTIONS:

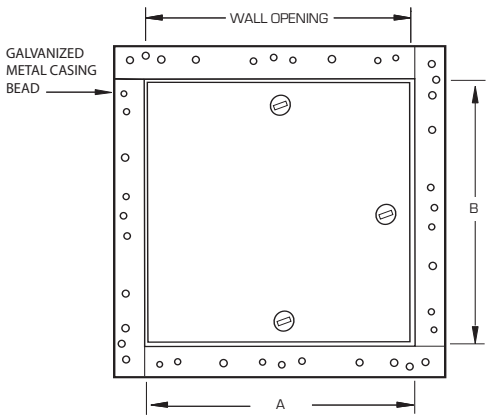
- ❑ Stainless Steel Type 304 No. 4 Satin Finish Brushed
- ❑ Stainless Steel Type 316 No. 4 Satin Finish Brushed

Options:

- ❑ WB 151 Key Code Cylinder locks-keyed alike with 2 keys per lock
- ❑ Mortise Best Lock
- ❑ Weather resistive neoprene gasketing on 3 sides*
- ❑ Special sizes available

✔	Item No.	Door Size W x H	Wall Opening	Cam Latch	Ship Wt. Lbs.
	DW 400	6 x 6	6 1/4 x 6 1/4	1	3
	DW 400	8 x 8	8 1/4 x 8 1/4	1	4
	DW 400	10 x 10	10 1/4 x 10 1/4	1	5
	DW 400	12 x 12	12 1/4 x 12 1/4	1	7
	DW 400	12 x 24	12 1/4 x 24 1/4	2	12
	DW 400	14 x 14	14 1/4 x 14 1/4	3	9
	DW 400	16 x 16	16 1/4 x 16 1/4	3	11
	DW 400	18 x 18	18 1/4 x 18 1/4	3	12
	DW 400	20 x 20	20 1/4 x 20 1/4	3	15
	DW 400	22 x 22	22 1/4 x 22 1/4	4	18
	DW 400	22 x 30	22 1/4 x 30 1/4	4	24
	DW 400	22 x 36	22 1/4 x 36 1/4	5	27
	DW 400	24 x 24	24 1/4 x 24 1/4	4	20
	DW 400	24 x 36	24 1/4 x 36 1/4	5	27
	DW 400	24 x 48	24 1/4 x 48 1/4	6	37
	DW 400	30 x 30	30 1/4 x 30 1/4	5	29
	DW 400	30 x 36	30 1/4 x 36 1/4	5	31
	DW 400	36 x 36	36 1/4 x 36 1/4	7	42

FRONT ELEVATION



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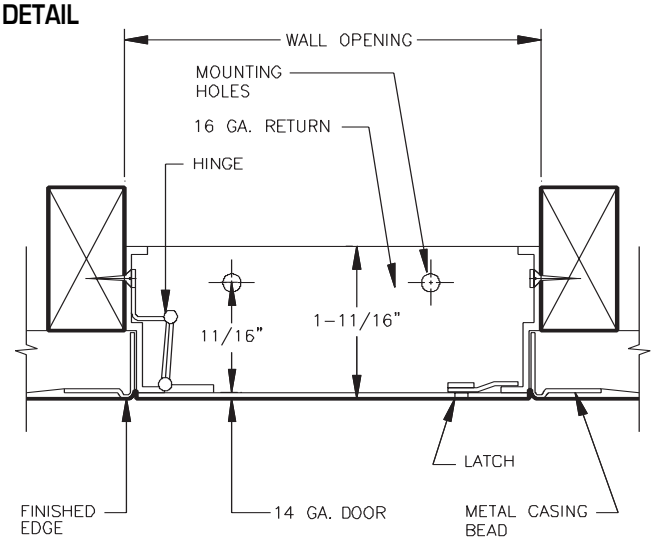


A quality flush panel door with a tape-in drywall bead flange, eliminates visual distraction created by projecting, surface-mounted units.

* Closed cell sponge, blend of Neoprene/EPDM/SBR. Meets ASTM D-1056: SCE 41, RE 41, 2A1; substrate UL 94HF-1 recognized.

Project:_____Date:_____

Contractor:_____Architect:_____

Sizes:_____ Quantity:_____ Approval Initials:_____

The Williams Bros. Corporation of America

Corporate Office:1330 Progress Drive • Front Royal, VA 22630
Phone: 1-800-255-5515 • Fax: 1-800-822-5001
www.wbdoors.com

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulated service doors.
2. Fire-rated, insulated service doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, and other accessories.
6. Include diagrams for power, signal, smoke control connection and control wiring.

C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats.
2. Include similar Samples of accessories involving color selection.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

B. Smoke Evacuation Operation: Design and install in coordination with Smoke Control system for automatic operation during smoke conditions.

2.3 INSULATED SERVICE DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Stormtite 625 by Overhead Door Corporation or comparable product by one of the following:

a. Cookson Company.
b. Cornell Iron Works, Inc.
c. Mahon Door Corporation.
d. McKeon Rolling Steel Door Company, Inc.
e. Raynor.
f. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Curtain R-Value: 7.7 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from galvanized steel and finished to match door.

G. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

H. Hood: Match curtain material and finish.

1. Shape: Round or square.
2. Mounting: Face of wall.

I. Electric Door Operator:

1. Usage Classification: Medium duty, up to 15 cycles per hour.
2. Operator Location: Front of hood.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Interior.
5. Emergency Manual Operation: Chain type.
6. Obstruction-Detection Device: Automatic pneumatic sensor edge on bottom bar.

a. Sensor Edge Bulb Color: Black.

7. Control Station(s): Interior mounted.

J. Curtain Accessories: Equip door with weatherseals and automatic closing device.

K. Door Finish:

1. PowderGuard™ Zinc Finish: Custom color as selected by Architect.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 FIRE-RATED INSULATED DOOR ASSEMBLY

A. Fire-Rated Insulated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Series 635 by Overhead Door Corporation or comparable product by one of the following:

a. Cookson Company.

b. Cornell Iron Works, Inc.
c. Mahon Door Corporation.
d. McKeon Rolling Steel Door Company, Inc.
e. Raynor.
f. Wayne-Dalton Corp.

B. Operation Cycles: Not less than 20,000.

C. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu.

D. Fire Rating: 1-1/2 hour and with smoke control.

E. Door Curtain Material: Galvanized steel.

1. Gage: 22.

F. Door Curtain Slats: Flat profile slats with manufacturer's standard center-to-center height.

G. Curtain Jamb Guides: Roll-formed steel.

H. Hood: 24 gage galvanized primed steel minimum for wall openings thru 19' wide. 22 gage galvanized primed steel for wall openings over 19' wide.

1. Shape: Round or square.
2. Mounting: Face of wall.

I. Locking Devices: Equip door with slide bolt for padlock.

J. Electric Door Operator:

1. Usage Classification: Medium duty, up to 15 cycles per hour.
2. Operator Location: Front of hood.
3. Motor Exposure: Interior.
4. Emergency Manual Operation: Crank type.
5. Obstruction Detection Device: Automatic electric sensor edge on bottom bar.
6. Remote-Control Station: Interior.

K. Automatic Closure:

1. Time delay release device. (tied to fire alarm and smoke evacuation system)

L. Door Finish:

1. Baked-Enamel Finish: Manufacturer's standard polyester top coat in gray color.

2.5 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 24 gage.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.7 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.8 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, nylon brushes.

B. Automatic-Closing Device for Smoke-Controled Doors: Equip each smoke-controled door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Release mechanism for motor- operated doors shall allow testing without mechanical release of the door. Automatic-closing device shall be designed for activation by the following:

1. Building smoke-detection, and alarm systems.

C. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:

1. Building fire-detection and -alarm systems and manufacturer's standard door-holder-release devices.

2.9 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

1. Smoke-Controlled Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location: Operator location indicated for each door.

1. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.

D. Motors: Reversible-type motor for motor exposure indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: 115 V.
c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

E. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

3.7 SCHEDULE

A. Loading Dock 1206:

1. Exterior Door: Insulated service door, electric operation, tied to smoke evacuation system.

B. Loading Dock 1207:

1. Exterior Door: Insulated service door, electric operation, tied to smoke evacuation system.
2. Interior Door: Fire-rated, insulated service doors, electric operation, tied to smoke evacuation system, tied to fire alarm system.

C. Loading Dock 1300:

1. Exterior Door: Insulated service door, electric operation, tied to smoke evacuation system.
2. Interior Door: Fire-rated, insulated service doors, electric operation, tied to smoke evacuation system, tied to fire alarm system.

D. Trash 1301:

1. Exterior Door: Insulated service door, electric operation, tied to smoke evacuation system.
2. Interior Door: Fire-rated, insulated service doors, electric operation, tied to smoke evacuation system, tied to fire alarm system.

END OF SECTION 083323

Insulated Rolling ServiceDoor Systems

SERIES

625

INDUSTRY LEADING
COMMERCIAL & INDUSTRIAL SOLUTIONS

Stormtite™ Insulated Heavy-Duty Rolling Service Doors

SERIES 625

Standard Features At a Glance

Max. standard width	30' (9144 mm)
Max. standard height	28' (8534 mm)
Curtain	24 ga. galvanized steel front 24 ga. galvanized steel back
Slat profile	Flat, insulated, type F-265i
Insulation	Foamed-in-place, CFC-free polyurethane
R-value	7.7 (1.35 W/Msq)
STC Rating	21
Finish	Gray, tan, brown or white
Hood	24 ga. galvanized steel
Wind load	20 psf
Standard mounting	Face of wall
Operation	Chain hoist
Standard springs	20,000 cycle
Weatherseals	Bottom, exterior curtain-side guide, interior hood baffle
Guides	Structural steel
Bottom bar	Primed steel with vinyl weatherseal
Lock	Chain keeper
Warranty	24-month limited; 3 years/20,000 cycles limited on Overhead Door door and operator system

Options

- Electric operator (RHX®, RSX®, RMX®)
- Aluminum or stainless steel slats
- Bottom sensing edge
- Crank operation
- Between-jambs mounting
- High-usage package
- High-wind load option (FBC, TDI, DADE)*
- Weatherseal for interior side guide
- Lintel seal
- Galvanized steel bottom bar angle guides
- Cylinder lock
- Pass doors
- Exhaust ports
- PowderGuard™ Premium Powder coat paint finish in 197 standard colors, or color-matched to specification
- PowderGuard™ Zinc and PowderGuard™ Weathered finishes also available

*FBC - Florida Building Code
TDI - Texas Department of Insurance
DADE - Miami-Dade Building Code Compliance Office

The Stormtite™ 625. Equal Measures

When overall performance and thermal efficiency are as essential in a rolling service door as are versatile good looks, the Stormtite™ 625 meets specification and exceeds all expectations. This heavy-duty door features insulated slats in a variety of materials — galvanized steel, stainless steel or aluminum — and offers optional wind load protection up to 20 psf. Designed to fit openings up to 30′ wide and 28′ high (9144 mm by 8534 mm) and offered with a broad range of product options, the versatility and functionality of the Stormtite™ 625 ensures that your design requirements will be met with ease, functionality and style.

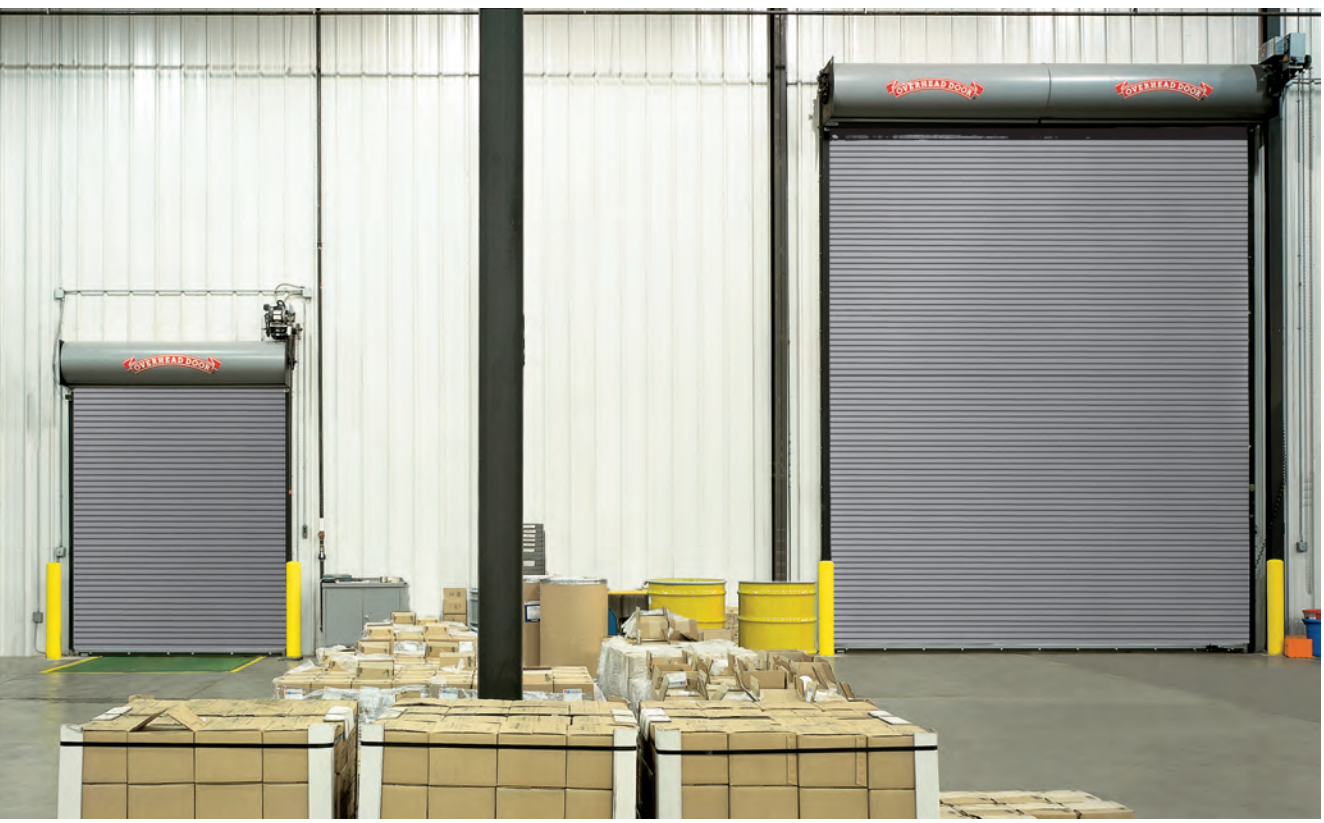
A Full-Featured Rolling Door With Added Thermal Protection.

The Stormtite™ 625 offers a complement of standard features plus the benefit of moderate protection against thermal transfer. The door's insulated F-265i slats incorporate a CFC-free, foamed-in-place polyurethane insulation that minimizes air infiltration and provides R-values to 7.7 (1.35 W/Msq).* Thermal efficiency is enhanced by vinyl weatherstripping on the bottom bar, exterior curtain-side guide at each jamb, and along the hood baffle. Additional weatherseals are optionally available on the interior side guide and lintel.

A Dependable, Durable Low-Maintenance Door.

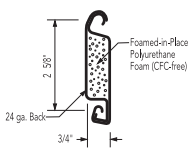
The Stormtite™ 625 is computer-designed and solidly constructed for dependable, long-lasting operation and low maintenance. Guides, bottom bar, brackets and hood are all fabricated of steel, and the door's counterbalance assembly features a helical torsion spring designed for a standard 20,000-cycles. Steel curtains are factory-finished with a rust-inhibited roll coating process that incorporates a baked-on primer and polyester top coat to eliminate field painting and improve finish life. Stainless steel and aluminum slats are offered with mill or anodized finishes for-long-lasting good looks. And if you opt for electric operation, our commercial operators are built to meet the exacting specification of our rolling service doors — providing safe, precise and reliable operation for years to come.

s of Style, Function and Thermal Efficiency.



Installation and Service: Overhead Door Company of Huntsville

Series 625
F-265i Slat



Finish Details	
Standard Polyester Base Coat:	Two-coat system with polyester based top coat.
PowderGuard™ Premium Powder Coat:	Weather resistant polyester powder coat available in 197 colors; custom color match and EZ Clean treatment options available. See Tiger Drylac® RAL Colors* brochure for color selection.
PowderGuard™ Zinc Finish:	Zinc enriched powder coat provides excellent corrosion protection that outperforms both hot dipped and cold galvanized steel. Color selection from 197 powder coat colors; custom color match also available.
PowderGuard™ Weathered Finish:	Industrial textured powder coat provides a thicker, more scratch resistant coat for added product protection.

*PowderGuard™ Premium Powder Coat colors are Tiger Drylac® or similar.

Many Options, Customized Solutions.

A wide array of options allow you to customize the Stormtite™ 625 to your project's needs. Material choices include 24-gauge galvanized steel front slat curtain as the standard, with 20 or 22-gauge steel, stainless steel or .040" (1 mm) aluminum as options. On steel slats, the standard finish is gray, tan, brown or white baked-on polyester paint. See chart above for more details on finish options.

Between-jambs mounting is offered as an alternative to standard face-of-wall installation. For larger or heavy-usage doors, the option of electric operation simplifies operation, while a host of safety features protect workers, equipment and products from injury or damage.

Extended Features for Special Applications.

The Stormtite™ 625 is available with a number of extended features for special applications. A higher windload package to meet stringent building codes in coastal areas is available upon request. T-shaped craneway doors can be built to nearly any size to accommodate large industrial equipment. Spark-resistant doors for use with explosion-proof electric operators offer added safety for volatile environments. Ask your Overhead Door Red Ribbon Distributor for more information about our special application Stormtite™ doors.

For additional information, or special project requirements, consult your Overhead Door Distributor or the Overhead Door Architectural Design Manual.

The Original, Innovative Choice for Unequalled Quality and Service

Overhead Door Corporation pioneered the upward-acting door industry, inventing the first upward-acting door in 1921 and the first electric door operator in 1926. Today, we continue to be the industry leader through the strength of our product innovation, superior craftsmanship and outstanding customer support, underscoring a legacy of quality, expertise and integrity. That's why design and construction professionals specify Overhead Door Corporation products more often than any other brand.

The Overhead Door Red Ribbon is a mark of quality that also reflects the pride we take in the people who support our products. Our family of over 400 Red Ribbon Distributors across the country not only share our name and logo, but also our commitment to excellence. Your Red Ribbon Distributor will work with you in a consultative role to ensure that product selections achieve your design and application requirements — in addition to offering expert installation, professional field service and ongoing maintenance. From project design and manufacturing to installation and service, the Overhead Door Red Ribbon is your guarantee of genuine quality and turnkey service excellence.

Together with our Red Ribbon Distributors, we offer comprehensive technical information and resource materials to support your project, including:

- **Architectural Design Manual – a comprehensive guide to selecting, specifying and detailing all commercial and industrial Overhead Door products can be found at www.OverheadDoor.com/ADM/base.html**
- **Operation & Maintenance Manual – detailed product information, customized for your project, to ensure reliable, long-life door system operation**
- **Custom application and technical assistance through ordering plants' customer service and technical services respectively**
- **Visit our Architect's Corner at www.OverheadDoor.com/architects corner**

Advanced Rolling Steel Door RapidSlat®

Thermacore® Sectional Doors

Rolling & Side Folding Security Grilles & Closures

Rolling Service Doors

Commercial Operators

Today, Overhead Door Corporation – along with our Horton Automatics division, for automated pedestrian entrances – is recognized as the leading, single-source manufacturer of integrated door and operator systems for commercial, industrial and residential applications. With multiple manufacturing locations throughout the United States, a state-of-the-art TREQ (Testing, Reliability, Engineering, and Quality) Center for design and engineering, and a national network of authorized Red Ribbon Distributors, our capabilities are leading-edge and our field service and technical support second to none. Built best and backed best, Overhead Door is the industry's leading choice for quality that shows and lasts.

To talk with the Overhead Door Red Ribbon Distributor nearest you, call 1-800-929-DOOR.

Overhead Door Corporation
2501 S. State Hwy. 121 Bus., Suite 200
Lewisville, Texas 75067
1-800-929-DOOR
www.OverheadDoor.com

Form #: C900-073 2M 5/12 JAR

OVERHEAD DOOR®

INDUSTRY LEADING
COMMERCIAL & INDUSTRIAL SOLUTIONS

The Overhead Door Corporation family of quality commercial and industrial products includes:

The Genuine. The Original. OVERHEAD DOOR® Horton AUTOMATICS

A part of Sanwa Shutter Corporation

The Genuine. The Original.

OVERHEAD DOOR®

FireKing®

Fire Door Collection

Fire protection, innovative design, optimized performance

FireKing®

The Genuine. The Original.

OVERHEAD DOOR®

Fire Door Collection

Fire protection, innovative design, optimized performance

Robust fire door product line designed to meet your project needs for fire and smoke protection.

Fire protection. Innovative design. Smooth performance.

The FireKing® Fire Door Collection by Overhead Door offers fire protection innovative design and optimized performance for the end user. Additional benefits including energy efficiency, climate control and sound control are available with our FireKing® Insulated Fire Door (635 Series).

FireKing® Fire Doors come equipped with an innovative floor reset system which allows these doors to be easily drop tested and mechanically reset at any time without requiring special tools.

Advantages

The FireKing® product line covers small, standard, and large door sizes for both insulated and non-insulated fire doors.

- Fire Doors are in compliance with:
  - National Fire Protection Association (NFPA-80)
  - Underwriters Laboratories (UL & ULC)
  - New York City and state of California (CSFM)
  - Factory Mutual (FM) – optional
  - UL listed smoke seal package ("S" label) – optional
- Features up to a four-hour rating on masonry, concrete and steel walls, and a three-hour rating on non-masonry walls to satisfy a variety of applications
- FireKing® Insulated Fire Door (635 Series) serves as a thermal barrier, ideal for applications which require separation due to climate control requirements
  - Energy efficiency, R-value of 4.5
  - Sound Transmission Class (STC) of 21, ideal for applications requiring sound control
  - Mineral wool slat insert offers Smoke and Flame Index of 5
- Wind load options available for Florida Building Code (FBC), Miami-Dade, Texas Department of Insurance (TDI)

Design and Performance

- Standardized component design with chain hoist
- Mechanical floor resettable hoist (non-motorized) enables easy drop test and reset of fire door in seconds without reapplying tension
- Viscous governor technology reduces noise and vibration providing smooth, quiet door operation
- Flexibility in mounting and operation type
- Can also be utilized for everyday operation, similar to a rolling steel door, eliminating the need for an additional door
- Additional fire and smoke protection options to give customer more extensive protection

Optimized Motor Operation

The RHX® FK motor operator is designed to work with the FireKing® fire door systems and offers advanced system features including:

- Availability in variety of horsepower ratings and voltage phases
- Mechanical floor resettable motor operation enables easy drop test and reset of fire door in seconds without reapplying tension
- Field retrofitable with FireKing® floor resettable chain hoist
- Meets National Fire Protection Agency (NFPA) 80 Standard, Underwriters Laboratories (cULus), Factory Mutual (FM), New York City, and the state of California (CSFM) code requirements
- 3 year or 20,000 cycle warranty on the RHX® FK system

FireKing®

Fire Door Collection

Fire protection, innovative design, optimized performance

The Genuine. The Original.

Robust fire door product line designed to meet your project needs for fire and smoke protection.

Floor resettable chain hoist (non-motorized)
Easily drop test and reset fire door in seconds.

Oil tempered torsion springs
Designed for 20,000 cycles as standard with higher cycle spring options available.

Energy-efficiency
Insulated with an R-value of 4.5 (635 Series only).

Sound transmission control
Curtain has an STC rating of 21 (635 Series only).

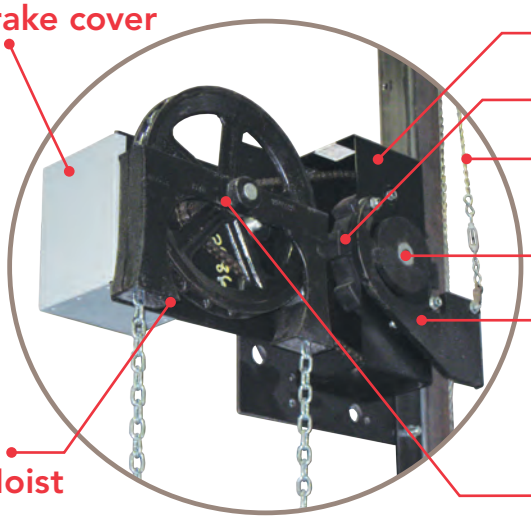
Optional smoke seal
Reduces the amount of smoke transferred from the fire side to the protected side.

Heavy-duty brush seal
Reduces air and dust infiltration.

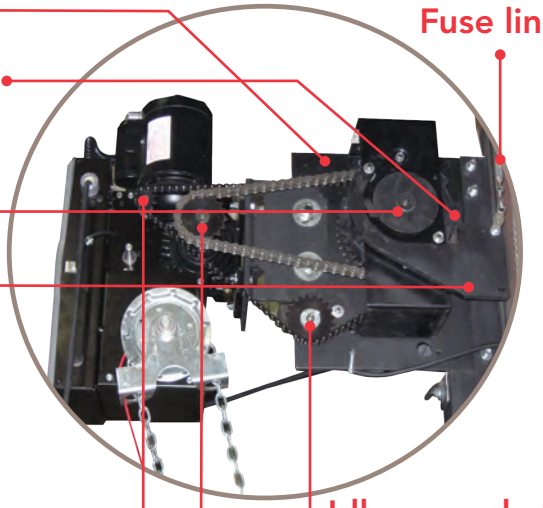
Structural angle guides and bottom bar
Provides smooth and reliable operation with PowderGuard™ powdercoat as standard.

Drive types
RHX® FK floor resettable motor, RHX®, RSX®, chain, crank.

Hoist Assembly View



RHX® FK Motor Assembly View



Fire Door Selection Chart

Series	630	631	634	635
Label				
UL/FM 1-1/2 hr (FM is optional)	*	* (No FM)		*
UL/FM 3 hr (FM is optional)	*	* (No FM)		*
ULC 3 hr	*	*		*
UL 4 hr			*	*
UL oversized door	* *	* * *	* *	* * *
FM (optional) oversized door	* * *			* * *
Applications				
Masonry	●	●	●	●
Non-masonry		●	●	●
Standard				
Maximum width	41'2" (12548 mm)	14' (4267 mm)	41'2" (12548 mm)	24' (7351 mm)
Maximum height	25'4" (7722 mm)	12' (3658 mm)	25'4" (7722 mm)	24' (7351 mm)
Curtain material	galv./ss	galv.	galv./ss	galv./ss
R-value				4.5
Sound Transmission Class				21 STC
Finish Color	gray/tan/white/brown	gray/tan/white/brown	gray/tan/white/brown	gray/tan/white/brown
Available Options				
Fire Sentinel® time-delay release device	●	●	●	●
Smoke detectors	●	●	●	●
FireLite® vision lites	●	●	●	●
UL listed brush-type smoke seals	●	●	●	●
Windload (FBC, TDI, Miami-Dade)	●	●	●	●
Operation Options				
Push-up	● (up to 80 sq ft or 7432 sq mm)	● (up to 80 sq ft or 7432 sq mm)	● (up to 80 sq ft or 7432 sq mm)	
Chain hoist	●	●	●	●
Crank	●	●	●	●
Electric Motor	●	●	●	●
Locking Option				
Cylinder locking bottom bar w/mortise cylinder	●	●	●	●
Finish Options				
Powder coat 197 premium colors	●	●	●	●

* (Up to 13'6" or 4115 mm width/height, max. 152 sq ft or 14121 sq mm)
** (Over 152 sq ft or 14121 sq mm)
*** (Over 152 sq ft or 14121 sq mm, but less than 18' or 5486 mm height) (FM reviews designs for openings over 18' or 5486 mm wide)
Note: ss = stainless steel, galv = painted, galvanized steel
Information is subject to change. Please call your local Overhead Door distributor for special applications or if your application is not listed.
All 635 Series doors are chain hoist minimum.

Product Application Chart

DOOR LABEL	MOUNTING	WALL CONSTRUCTION	MAXIMUM WIDTH	MAXIMUM HEIGHT	MAXIMUM AREA	CERTIFYING AGENCY
4 hours	Face of Wall and Between the Jambs*	Masonry/Steel	13'-6"	13'-6"	152 sq ft	UL
4 hours	Face of Wall and Between the Jambs*	Masonry/Steel	12'	10'	120 sq ft	FM
Oversize 4 hours	Face of Wall and Between the Jambs*	Masonry/Steel	41'-2"	25'-4"	683 sq ft	UL
Oversize 4 hours	Face of Wall and Between the Jambs*	Masonry/Steel	18'	18'	324 sq ft	FM
3 hours	Face of Wall and Between the Jambs*	Non-masonry	12'	12'	144 sq ft	UL
1 ½ hours	Face of Wall and Between the Jambs*	Non-masonry	12'	10'	117 sq ft	FM
Oversize 3 hours	Face of Wall and Between the Jambs*	Non-masonry	14'	12'	168 sq ft	UL
Oversize 1 ½ hours	Face of Wall	Non-masonry	14'	11'	140 sq ft	FM
Oversize 3 hours	Face of Wall and Between the Jambs*	Steel Tube inside Non-masonry	16'	14'	224 sq ft	UL
Oversize 1 ½ hours	Face of Wall	Steel Tube inside Non-masonry	14'	11'	140 sq ft	FM
3 hours	Face of Wall	Steel Tube on masonry or Non-masonry	12'	12'	144 sq ft	UL
3 hours	Face of Wall	Steel Tube on masonry or Non-masonry	12'	10'	120 sq ft	FM
Oversize 3 hours	Face of Wall	Steel Tube on masonry or Non-masonry	24'	24'	576 sq ft	UL

* Between Jambs Doors are based on width of wall and from floor to top of coil (under lintel).
Factory Mutual (FM) reviews each size above the over size service on a case-by-case basis

Available Options

 **Fire Sentinel®**	Time-delay release device
FireLite® vision lite	Available in 1-1/2 hr, 3 hr, and 4 hr labels
 **Smoke detectors Heat detectors**	Photoelectric smoke detectors. Heat detectors are also available.
Smoke seal	UL-listed brush-type smoke seals ("S" label) to satisfy smoke retardation requirements of certain applications.
Flame baffle system	A Factory Mutual (FM) requirement.
FM Label	FM labels are available in 1-1/2 hr, 3 hr, and oversized door.
Horns	Horns and horns with strobes are available.
Wind load	Approved wind load options available for Florida Building Code (FBC), Miami-Dade and Texas Department of Insurance (TDI)
Crank or electric operation	To satisfy a variety of applications. See page 10 for more detailed information.

Technical Data	
Application	Exterior/Interior for fire rated walls
Mounting position	Between the jambs Face of wall
Operation options	Standard offering: mechanical floor resettable hoist Option: crank Option: electric motor; RHX® FK, RHX® or RSX®
Models	630 – standard fire door 631 – smaller fire door 634 – larger fire door (4 hour rating UL/FM) 635 – insulated fire door
Wind load options	Florida Building Code (FBC) Miami-Dade Texas Department of Insurance (TDI)
Drop speed	Meets NFPA 80 requirements of 6" to 24" per second
Compliance	Underwriters Laboratories (UL & ULC) – standard Meets New York City and state of California CSFM Factory Mutual (FM) – optional UL "S" label - optional
Warranty	Two-year limited warranty coverage on material and workmanship
Curtain	
Material	Steel slats in a variety of gauges. Stainless steel optional.
Finish	Standard offering: gray, tan, white, brown Optional: 197 powder coat colors Finish to match architect specification
Counterbalance System	
Counterbalance	High tensile helical torsion spring housed in a steel tube or pipe barrel assembly
Brackets	Steel plates to support counterbalance, curtain and hood
Hoist	Standard offering: mechanical floor resettable hoist system
Guides & Bottom Bar	
Guides	Three structural steel angles with a minimum thickness of 1/4" (6 mm) mounted to face of jamb. Also includes a locking bar or wind bar.
Bottom bar	Two structural steel angles 1-1/2" by 1-1/2" by 1/8" minimum. Galvanized steel available as an option. Applications: Single angle for conveyor Optional sloping bottom bar with UL limits Optional insulated bottom bar

Overhead Door's FireKing®

Competition

Maximum insulation

The mineral wool insulation material used in FireKing® insulated fire doors is compressed within the steel slat, completely and uniformly filling the slat for maximum insulation. Overhead Door provides consistent quality in design and performance of our products.

Powder coat options

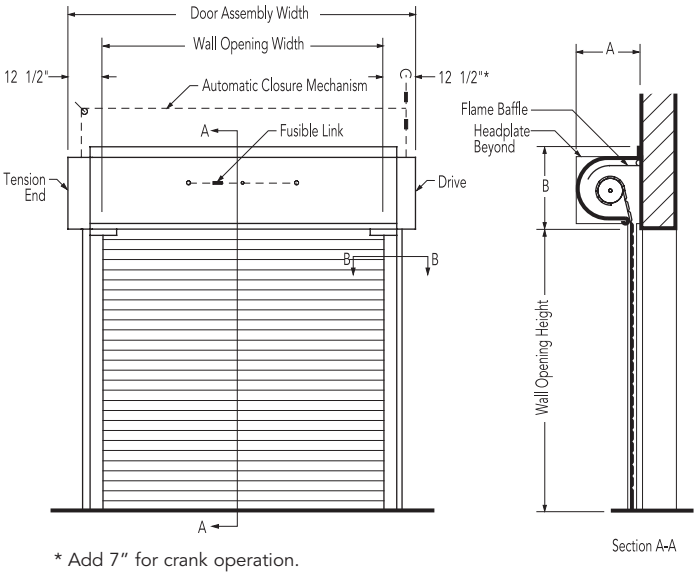
Powder coat paint finish is available in 197 colors, or may be color matched to architect's specifications to best complement the look of the facility.

Door Clearance Elevation

Operation: crank, chain hoist*, electric

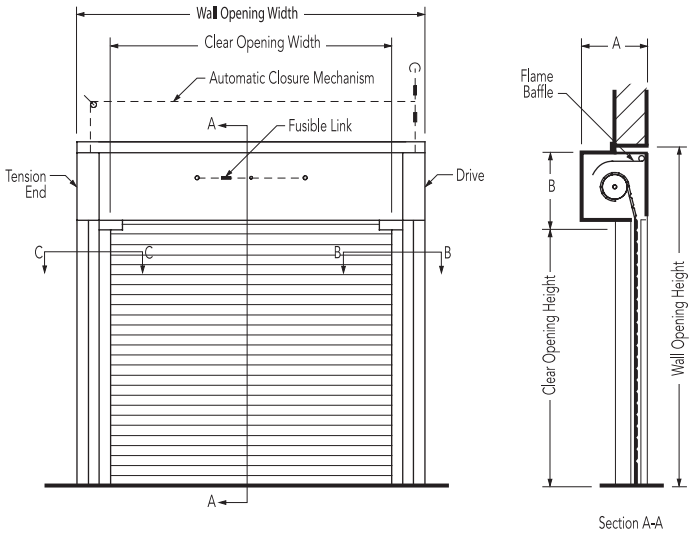
* Note: Chain hoist has only one sash chain located on drive side.
Note: For dimensions, refer to Headroom and Guide Clearance Dimension charts applicable to door type selected.

Face-of-Wall Mounted



* Add 7" for crank operation.

Between Jambs Mounted

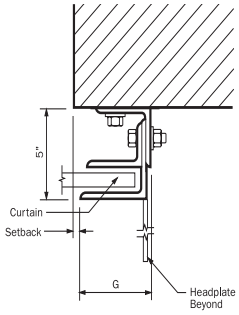


** Options may effect clearance dimensions.*
For more detailed information, consult your local Overhead Door Distributor.

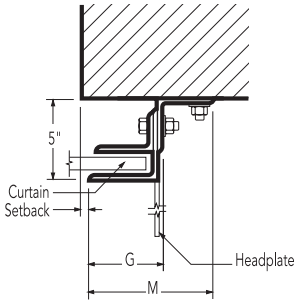
Face-of-Wall–Angle Guides

Section B-B

E Type

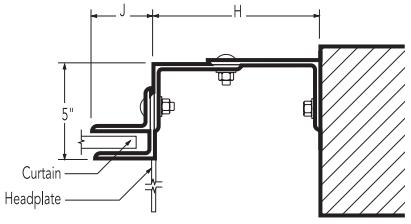


Z Type



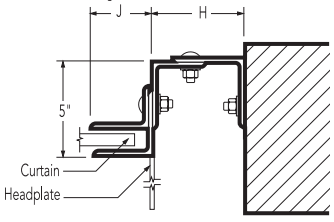
Between Jambs–Angle Guides

Drive Side - Electric, Chain or Crank
Section B-B



Whenever expansion mounting bolts are used maintain a minimum of 6 bolt diameters from edge of wall

Tension Side & Push-up Drive Side
Section C-C



Whenever expansion mounting bolts are used maintain a minimum of 6 bolt diameters from edge of wall

Headroom Clearance Dimensions

C187 Slats – Dimensions A and B

Max. Wall Opening Height*	C187 Slat Thru 14′ - 0″ Wide				Thru 20′ - 0″ Wide				Hood Angle Height		Expansion Gap	
	A		B**		A		B**					
Thru 8′0″ (2438 mm)	17 1/2″	(445 mm)	19 5/8″	(498 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 1/4″	(32 mm)
Thru 10′0″ (3048 mm)	17 1/2″	(445 mm)	19 5/8″	(498 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 1/2″	(38 mm)
Thru 11′0″ (3353 mm)	21 1/2″	(597 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 3/4″	(45 mm)
Thru 12′0″ (3658 mm)	21 1/2″	(597 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 3/4″	(45 mm)
Thru 13′0″ (3962 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	4″	(102 mm)	2″	(51 mm)
Thru 14′0″ (4267 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	4″	(102 mm)	2″	(51 mm)
Thru 16′0″ (4877 mm)	21 1/2″	(597 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	4″	(102 mm)	2 1/4″	(57 mm)
Thru 18′0″ (5486 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	4″	(102 mm)	2 1/2″	(64 mm)
Thru 19′0″ (5791 mm)	21 1/2″	(597 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	4 3/4″	(121 mm)	2 3/4″	(70 mm)
Thru 21′0″ (6401 mm)	21 1/2″	(597 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	4 3/4″	(121 mm)	3″	(76 mm)
Thru 24′0″ (7315 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	25 1/2″	(546 mm)	27 5/8″	(702 mm)	4 3/4″	(121 mm)	3 1/4″	(83 mm)

C275 Slats – Dimensions A and B

Max. Wall Opening Height*	C275 Slat Thru 14′ - 0″ Wide				Thru 20′ - 0″ Wide				Thru 24 - 0″ Wide				Hood Angle Height		Expansion Gap	
	A		B**		A		B**		A		B**					
Thru 8′0″ (2438 mm)	19 1/2″	(495 mm)	21 5/8″	(549 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 1/4″	(32 mm)
Thru 10′0″ (3048 mm)	19 1/2″	(495 mm)	21 5/8″	(549 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 1/2″	(38 mm)
Thru 11′0″ (3353 mm)	19 1/2″	(495 mm)	21 5/8″	(546 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	3 1/4″	(83 mm)	1 3/4″	(45 mm)
Thru 12′0″ (3658 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	3 1/4″	(83 mm)	1 3/4″	(45 mm)
Thru 13′0″ (3962 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	4″	(102 mm)	2″	(51 mm)
Thru 14′0″ (4267 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	4″	(102 mm)	2″	(51 mm)
Thru 16′0″ (4877 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	25 1/2″	(651 mm)	27 5/8″	(702 mm)	4″	(102 mm)	2 1/4″	(57 mm)
Thru 18′0″ (5486 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)					4″	(102 mm)	2 1/2″	(64 mm)
Thru 19′0″ (5791 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)					4 3/4″	(121 mm)	2 3/4″	(70 mm)
Thru 21′0″ (6401 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)					4 3/4″	(121 mm)	3″	(76 mm)
Thru 24′0″ (7315 mm)	25 1/2″	(648 mm)	27 5/8″	(702 mm)									4 3/4″	(121 mm)	3 1/4″	(83 mm)

*Consult factory

F265 Slats – Dimensions A and B

Max. Wall Opening Height*	F265 Slat Thru 14′ - 0″ Wide				Thru 20′ - 0″ Wide				Thru 24 - 0″ Wide				Hood Angle Height		Expansion Gap	
	A		B**		A		B**		A		B**					
Thru 8′0″ (2438 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 1/4″	(32 mm)
Thru 10′0″ (3048 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	3 1/4″	(83 mm)	1 1/2″	(38 mm)
Thru 11′0″ (3353 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	3 1/4″	(83 mm)	1 3/4″	(45 mm)
Thru 12′0″ (3658 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	3 1/4″	(83 mm)	1 3/4″	(45 mm)
Thru 13′0″ (3962 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	4″	(102 mm)	2″	(51 mm)
Thru 14′0″ (4267 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	21 1/2″	(546 mm)	23 5/8″	(600 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	4″	(102 mm)	2″	(51 mm)
Thru 16′0″ (4877 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	25 1/2″	(651 mm)	27 5/8″	(702 mm)	4″	(102 mm)	2 1/4″	(57 mm)
Thru 18′0″ (5486 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)					4″	(102 mm)	2 1/2″	(64 mm)
Thru 19′0″ (5791 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	25 1/2″	(648 mm)	27 5/8″	(702 mm)					4 3/4″	(121 mm)	2 3/4″	(70 mm)
Thru 21′0″ (6401 mm)	23 1/2″	(597 mm)	25 5/8″	(651 mm)	27 1/2″	(699 mm)	29 5/8″	(752 mm)					4 3/4″	(121 mm)	3″	(76 mm)
Thru 24′0″ (7315 mm)													4 3/4″	(121 mm)	3 1/4″	(83 mm)

*Consult factory

C187 C275 F265 Slats – **Dimensions G and M*** ** Guide Clearance Dimensions

Max. Wall Opening Widths*	G		M		J		H (Tension End)	
Thru 8′0″ (2438 mm)	3 1/4″	(83 mm)	5 1/2″	(140 mm)	2 3/4″	(70 mm)	4″	(102 mm)
Thru 12′0″ (3658 mm)	3 3/4″	(95 mm)	6″	(152 mm)	3 1/4″	(83 mm)	4″	(102 mm)
Thru 14′0″ (4267 mm)	4″	(102 mm)	5 3/4″	(146 mm)	3 1/2″	(89 mm)	4″	(102 mm)
Thru 16′0″ (4877 mm)	4 1/4″	(108 mm)	6″	(152 mm)	3 1/2″	(89 mm)	4 1/2″	(114 mm)
Thru 20′0″ (6401 mm)	4 3/4″	(121 mm)	7″	(178 mm)	4 1/4″	(108 mm)	4 1/2″	(114 mm)
Thru 24′0″ (7315 mm)	5 3/4″	(146 mm)	8″	(203 mm)	5 1/4″	(133 mm)	5 1/4″	(133 mm)

Dimension H*** Drive End Type of Operation	H
Push-Up	4″
Chain, Crank	7 1/2″
RSX®	7 1/2″
RHX®	8 1/2″

*Height limit for non-masonry jambs is 12'0" (3658 mm). **Add 2" (51 mm) for electric operation. ***For max. wall opening height of 12' (3658 mm).

Slat Data

630 Face-of Wall Mounted			
Slat	**Opening Width**	**Standard**	**Optional**
C187	Thru 14'0" (4267 mm)	22 ga.*	20 ga. or 22 ga. ss
	Thru 20'0" (6096 mm)	20 ga.	18 ga. or 20 ga. ss
C275	Thru 14'0" (4267 mm)	22 ga.*	20 ga. or 22 ga. ss
	Thru 20'0" (6096 mm)	20 ga.	18 ga. or 20 ga. ss
	Thru 41'2" (12548 mm)	18 ga.	16 ga.
F265	Thru 14'0" (4267 mm)	22 ga.*	20 ga. or 22 ga. ss
	Thru 20'0" (6096 mm)	20 ga.	18 ga. or 20 ga. ss
	Thru 41'2" (12548 mm)	18 ga.	

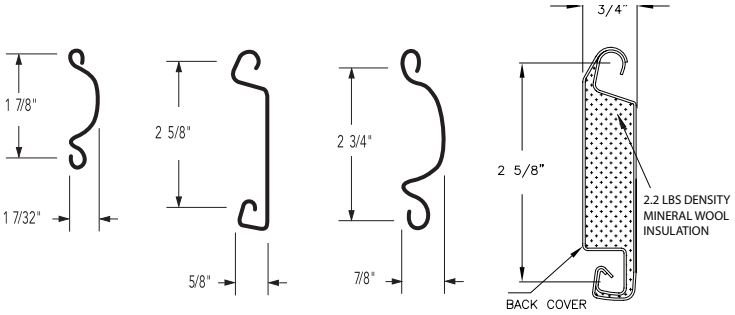
631 Face-of Wall Mounted			
Slat	**Opening Width**	**Standard**	
C187	Thru 14'0" (4267 mm)	24 ga.	
F265	Thru 14'0" (4267 mm)	24 ga.	

634 Face-of Wall Mounted			
Slat	**Opening Width**	**Standard**	**Optional**
C187	Thru 20'0" (4267 mm)	20 ga.	18 ga. or 20 ga. ss
C275	Thru 20'0" (6096 mm)	20 ga.	18 ga. or 20 ga. ss
	Thru 41'2" (12548 mm)	18 ga.	16 ga.
F265	Thru 20'0" (6096 mm)	20 ga.	18 ga. or 20 ga. ss
	Thru 41'2" (12548 mm)	18 ga.	

635 Face-of Wall Mounted or Between the Jamb Mount			
Slat	**Opening Width**	**Standard**	**Optional**
F265 with back cover	Thru 24'0" wide	24 ga. front	22 ga. front
		24 ga. back	22 ga. back

Slats are galvanized and painted or stainless steel (ss).
** Maximum wall opening height for 22 ga. is 12'0" (3658 mm).*

C-187 Slat **F-265 Slat** **C-275 Slat** **F-265i Slat**



Electric Operator Selection Guide

	Horsepower	Rolling Door*	6-rib poly J-belt	Worm gear	Adjustable clutch	Totally enclosed	Continuous duty	Mounting type
Model RHX® FK	½, ¾, 1, 3 HP	400 (37161)		•	•	•	•	F
Model RHX®	½, ¾, 1 HP	480 (44591)		•	•	•	•	F,W,T
Model RSX®	½, ¾,1 HP	168 (15607)	•		•	•	•	F,W,T

Mounting Options: F = Front of Hood, W = Wall, T = Top of Hood
* Maximum area in square feet (square millimeters).

Electric Operators

The Overhead Door® automatic door operator product line is manufactured to meet the performance requirements of our commercial and industrial doors, offering precise control of your door system for years of trouble-free operation. To improve safety and enhance the life of your door and motor, the industry's guidelines for quality assurance recommend a single manufacturer for both door and operator. Overhead Door® commercial operators are UL 325 2010 compliant.

Entrapment Protection

Overhead Door Corporation strongly recommends the use of a primary safety device as defined by UL 325 2010. A primary safety device can be approved monitored photo-eyes or an approved monitored sensing edge. If a primary safety device is not installed, a constant contact control switch must be used to close the door. Contact Overhead Door for more information.

With the optional selection of a commercial operator for the Fire Door system the floor resettable chain hoist is not available.

Model RHX® FK

Model RHX® FK is a heavy duty motor featuring industrial gearbox in oil bath design. It offers unique features like LimitLock™, dual frequency radio system and 16 digit menu setup. Combined with FireKing® fire doors this system offers a unique floor resettable feature as well as providing for easy drop test and reset of fire door within seconds.

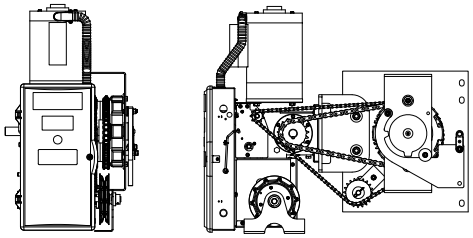
Model RHX®

Model RHX® is a heavy duty motor featuring industrial worm gear in oil bath design. The RHX® can operate doors up to 24' (7315 mm) in height and 1650 pounds (748 kg) in weight.

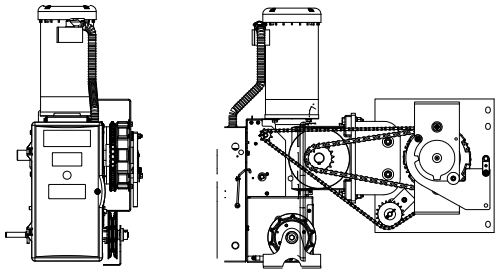
Model RSX®

Model RSX® is a standard dutycommercial operator designed tooperate doors up to 24' (7315 mm) in height and 1450 pounds (657 kg) in weight.
It offers unique features like LimitLock™, SuperBelt™, dual frequency radio system and 16 digit menu setup.

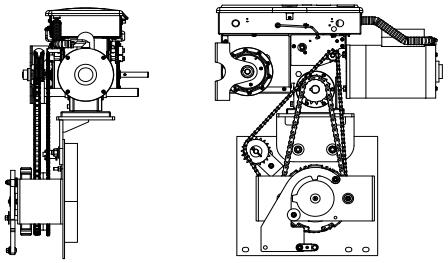
Front-of-Hood Mounted-RHX® FK 1 HP



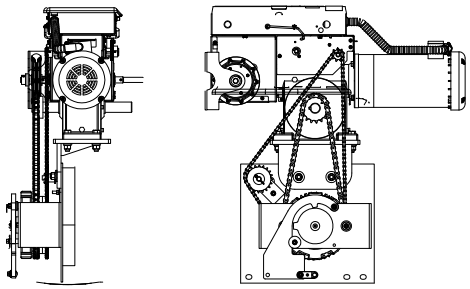
Front-of-Hood Mounted-RHX® FK 3 HP



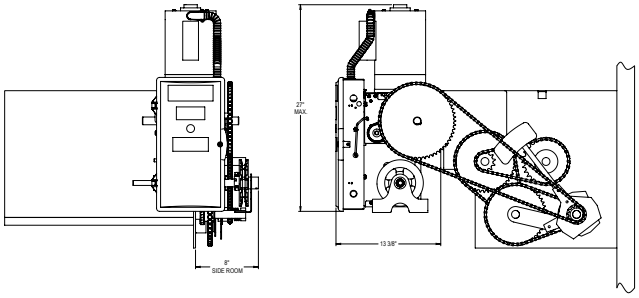
Top-of-HoodMounted-RHX® FK 1 HP



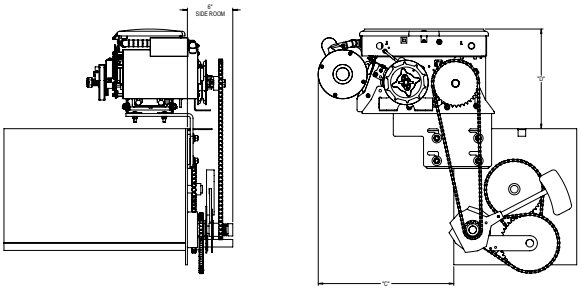
Top-of-HoodMounted-RHX® FK 3 HP



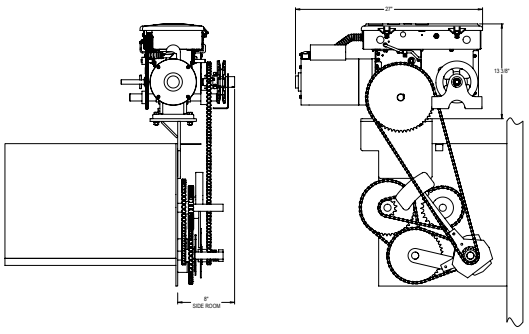
Front-of-Hood Mounted-RHX®



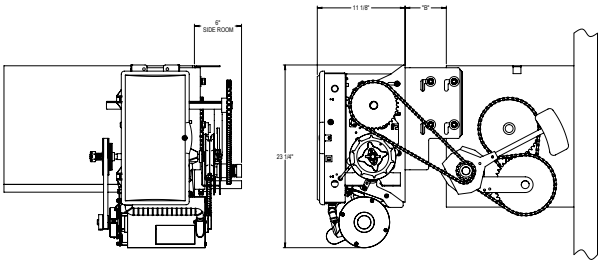
Front-of-Hood Mounted-RSX®**



Top-of-Hood Mounted -RHX®



Top-of-Hood-RSX®



*** Front-of-Hood mounted also available on between jambs mounted doors. For more detailed information, consult your local Overhead Door Distributor.*

The Service and Support You Need – When You Need Them

When you select an Overhead Door product, you get more than advanced product design and manufacturing superiority – you get unmatched support and fast response through our nationwide network of over 400 Red Ribbon Distributors. For over four generations, Red Ribbon Distributors have provided the industry's single-source solution for commercial and industrial door and operator systems specifically designed for integrated applications. From design and application consulting to installation and ongoing maintenance, Overhead Door Red Ribbon Distributors give you the service and support you need — when you need them.

Warranty

FireKing® doors are guaranteed with a 2-year limited warranty. See complete warranty terms for full limitations and details.

The Genuine. The Original.

OVERHEAD DOOR®

2501 S. State Hwy.121 Bus., Suite 200
Lewisville, TX 75067

1-800-929-DOOR
www.OverheadDoor.com
sales@OverheadDoor.com

Complies with UL 10B as of manufactured date. FCC Certified.

SOLD AND DISTRIBUTED BY:

SECTION 083326 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Open-curtain overhead coiling grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, and other accessories.

C. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Open-curtain grille with full-size components consisting of rods, spacers, and links as required to illustrate each assembly.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-grille manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Overhead coiling grilles shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.0.

2.3 OPEN-CURTAIN GRILLE ASSEMBLY

A. Open-Curtain Grille: Overhead coiling, countertop grille with a curtain having a network of horizontal rods that interconnect with vertical links.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cookson Company.
b. Cornell Iron Works, Inc.
c. Lawrence Roll-Up Doors, Inc.
d. Mahon Door Corporation.
e. McKeon Rolling Steel Door Company, Inc.
f. Overhead Door Corporation.
g. Raynor.

B. Operation Cycles: Grille components and operators capable of operating for not less than 20,000. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

C. Grille Curtain Material: Aluminum.

1. Rod Spacing: Approximately 3 inches o.c.
2. Link Spacing: Approximately 9 inches apart in a straight in-line pattern.
3. Spacers: Metal tubes matching curtain material.

D. Bottom Bar: Continuous tubular shape, fabricated from aluminum extrusion and finished to match grille.

E. Curtain Jamb Guides: Aluminum with exposed mill finish. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

F. Hood: Match curtain material and finish.

1. Shape: Round or Square.
2. Mounting: Face of wall.

G. Locking Devices: Equip grille with locking device assembly.

1. Locking Device Assembly: Single-jamb side locking bars, operable from outside only, with cylinder.

H. Manual Grille Operator: Push-up operation.

I. Curtain Accessories: Equip grille with push/pull handles and poll hook.

J. Grille Finish:

1. Aluminum Finish: Clear anodized.

2.4 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.

1. Aluminum Grille Curtain: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Bottom Bar: Manufacturer's standard continuous shape unless otherwise indicated, finished to match grille.

1. Astragal: Equip grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

C. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.5 HOODS AND ACCESSORIES

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040-inch- thick aluminum sheet, complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

B. Push/Pull Handles: Equip push-up-operated or emergency-operated grille with lifting handles on each side of grille, finished to match grille.

C. Pole Hooks: Provide pole hooks and poles for grilles more than 84 inches high.

2.6 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: Cylinders specified in Section 087100 "Door Hardware".

2.7 COUNTERBALANCING MECHANISM

A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL GRILLE OPERATORS

A. General: Equip grille with manual grille operator by grille manufacturer.

B. Push-up Grille Operation: Lift handles and pull rope for raising and lowering grille, with counterbalance mechanism designed so that required lift or pull for grille operation does not exceed 25 lbf.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Mill Finish: Manufacturer's standard.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly, so that grilles operate easily, free of warp, twist, or distortion.

1. Adjust exterior components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-grille Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for grille operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 083326

Security Upward-Coiling Grille Systems

SERIES

670

671

OVERHEAD DOOR®

INDUSTRY LEADING
COMMERCIAL & INDUSTRIAL SOLUTIONS

Standard Features At a Glance

Warranty	1-year limited
Operation	Manual
Curtain	
Material	Aluminum (670 Series) Steel (671 Series) Optional: fire-retardant polycarbonate panels
Pattern	Straight lattice: 5/16" (8 mm) rods at 2" (51 mm) on center and links at 9" (229 mm) on center Optional: Staggered brick: 5/16" (8 mm) rods at 2" (51 mm) on center, and links at 4 1/2" (114 mm) on center Optional: Curtain with polycarbonate 5/16 (8 mm) rods at 3" (76 mm) on center and links at 12" (305 mm) on center
Finish	Mill finish on aluminum; 2B on stainless; galvanized on steel
Guide type	Aluminum extruded track
Mounting	Face mount with wall angle Between the jambs on 3" x 3" (76 mm x 76 mm) Or 4" x 4" (102 mm x 102 mm) structural steel tubes
Locking	Slide bolt for manual and chain operation Chain lock for chain hoist operation

Options

- Electric operator, chain hoist, removable awning crank or crank box
- Electric operator with automatic emergency egress
- Emergency egress operation with manual release
- Aluminum curtain with polycarbonate filler panels
- 24-gauge galvanized steel hood
- Heavy-usage package
- Anodized finishes: clear, bronze (aluminum)
- No. 4 finish (stainless)
- Powder coat paint finish in 197 standard colors or color matched to your specification
- Controls: time clock, card reader, keypad access
- Cylinder lock

The 670 and 671 Series. Security

When your project calls for an upward-coiling grille that is as versatile and attractive as it is rugged and secure, look no further than the 670 and 671 Series. These grilles provide an attractive yet functional means to secure areas where public access must be restricted, without blocking air, light or sight. A wide range of options – including the choice of material, curtain pattern and inserts, finish, type of operator, 24-gauge steel hood, and heavy-usage package – make these grilles an ideal choice for interior or exterior use in a variety of retail, industrial and commercial settings.

The Choice of Aluminum, Steel or Stainless.
The 670 and 671 Series offers a choice of curtain materials to meet the aesthetic and functional requirements of most any environment. The 670 Series features an aluminum (670 Series) curtain, with optional fire-retardant polycarbonate inserts. The 671 Series is fabricated of galvanized steel, with stainless steel available as an option with optional fire retardant polycarbonate inserts. The standard curtain pattern for both the 670 and 671 Series is a straight lattice configuration, but you can opt for a staggered brick design.

High-Performance, Low Maintenance.
The 670 and 671 Series are built for long-lasting, trouble-free performance. The counterbalance assembly features heavy-duty helical torsion springs in a steel tube or pipe barrel to provide long and reliable service. Guides feature silicon woolpile strips or PVC inserts for ease of operation and noise reduction. Surfaces are factory pre-finished to minimize field preparation and enhance the finish's durability. Optional crank operation or electric operation further simplifies grille operation. An optional heavy usage package provides extended life in applications requiring higher-duty cycles, such as parking garages and service access gates.

That's Both Practical and Stylish.

Installation and Service: Overhead Door Company of Huntsville

Emergency Egress Options

For public building applications, where grilles are utilized to secure access to public areas, an emergency egress may be necessary to prevent entrapment in the event of emergency or power failure. Applications including hospitals, schools, office buildings and libraries are ideal for adding this safety option to the door system. The emergency egress allows exit in the event of an alarm or power failure. The door is unlocked and therefore allowing exit. This feature avoids entrapment as well as provides immediate access to emergency personnel. Overhead Door offers two different ways to implement the emergency egress option. Both ways meet the IBC 1008.1.4.4 requirements. One option is the auto unlock and auto release option using an egress electric operator system designed specifically to work with Overhead Door emergency egress. The other option is the auto unlock and manual release which can be operated with standard Overhead Door commercial operators.

Optional Electric Operation

The 670 and 671 Series grilles are available with an electric operator to provide automatic passage for a variety of commercial and industrial uses, including schools, hospitals, libraries, public access buildings and parking garages. Our commercial operators are designed specifically for the 670 and 671 Series grilles to ensure precise, smooth and safe operation for years to come. These operators are available with a variety of safety and actuator options that make the 670 and 671 Series grilles suitable for nearly any commercial or retail application. These options include:

- Entrapment protection, including an electric or pneumatic sensing edge or photoelectric sensors
- Push-button, key or combination stations; surface or flush-mounted for interior or exterior locations
- Vehicle detectors, key card readers, photocell and door timer controls
- Treadle or pull-switch stations
- Telephone entry and coded keyboard stations
- Universal programmable door timer
- Radio control systems (24 VAC or 120 VAC)
- Emergency Egress allows for exiting without electrical power

For additional information, or special project requirements, consult your Overhead Door distributor or the Overhead Door Architectural Design Manual.

The Original, Innovative Choice for Unequalled Quality and Service

Overhead Door Corporation pioneered the upward-acting door industry, inventing the first upward-acting door in 1921 and the first electric door operator in 1926. Today, we continue to be the industry leader through the strength of our product innovation, superior craftsmanship and outstanding customer support, underscoring a legacy of quality, expertise and integrity. That's why design and construction professionals specify Overhead Door Corporation products more often than any other brand.

The Overhead Door Red Ribbon is a mark of quality that also reflects the pride we take in the people who support our products. Our family of over 400 Red Ribbon Distributors across the country not only share our name and logo, but also our commitment to excellence. Your Red Ribbon Distributor will work with you in a consultative role to ensure that product selections achieve your design and application requirements — in addition to offering expert installation, professional field service and ongoing maintenance. From project design and manufacturing to installation and service, the Overhead Door Red Ribbon is your guarantee of genuine quality and turnkey service excellence.

Together with our Red Ribbon Distributors, we offer comprehensive technical information and resource materials to support your project, including:

- **Architectural Design Manual – a comprehensive guide to selecting, specifying and detailing all commercial and industrial Overhead Door products can be found at www.OverheadDoor.com/ADM/base.html**
- **Operation & Maintenance Manual – detailed product information, customized for your project, to ensure reliable, long-life door system operation**
- **Custom application and technical assistance through ordering plants' customer service and technical services respectively**
- **Visit our Architect's Corner at www.OverheadDoor.com/architects corner**

Advanced Rolling Steel Door RapidSlat®

Thermacore® Sectional Doors

Rolling & Side Folding Security Grilles & Closures

Rolling Service Doors

Commercial Operators

Today, Overhead Door Corporation – along with our Horton Automatics division, for automated pedestrian entrances – is recognized as the leading, single-source manufacturer of integrated door and operator systems for commercial, industrial and residential applications. With multiple manufacturing locations throughout the United States, a state-of-the-art TREQ (Testing, Reliability, Engineering, and Quality) Center for design and engineering, and a national network of authorized Red Ribbon Distributors, our capabilities are leading-edge and our field service and technical support second to none. Built best and backed best, Overhead Door is the industry's leading choice for quality that shows and lasts.

To talk with the Overhead Door Red Ribbon Distributor nearest you, call 1-800-929-DOOR.

Overhead Door Corporation
2501 S. State Hwy. 121 Bus., Suite 200
Lewisville, Texas 75067
1-800-929-DOOR
www.OverheadDoor.com

OVERHEAD DOOR®

INDUSTRY LEADING
COMMERCIAL & INDUSTRIAL SOLUTIONS

The Overhead Door Corporation family of quality commercial and industrial products includes:

The Genuine. The Original. OVERHEAD DOOR® Horton

A part of Sanwa Holdings Corporation

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Storefront framing for window walls.
3. Exterior and interior manual-swing entrance doors and door-frame units.
4. Miscellaneous break metal flashing.

B. Related Requirements:

1. Section 084413 "Glazed Aluminum Curtain Walls" for framing systems receiving entrance doors and frames.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: One year from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.

c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

a. Basic Wind Speed: 100 mph.
b. Importance Factor: 1.15.
c. Exposure Category: B.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

2. Entrance Doors:

a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..
2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than the following values as determined according to NFRC 500.

    a. Frame: 62.
    b. Glass: 68.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    b. Low Exterior Ambient-Air Temperature: 0 deg F.
    c. Interior Ambient-Air Temperature: 75 deg F.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide indicated products by one of the following:

B. Products:

1. Exterior Aluminum-Framed Storefronts:

    a. Kawneer: Trifab VG 451 T.
    b. EFCO: System 403.
    c. Tubelite: 14000 Series.
    d. Vistawall: 3000 Thermal MultiPlane.
    e. YKK AP: YES 45 TU.

2. Interior Aluminum-Framed Storefronts:

    a. Kawneer: Trifab VG 451.
    b. EFCO: System 402.
    c. Tubelite:
    d. Vistawall: 3000 non-thermal MultiPlane.
    e. YKK AP: YES 45 FI.

3. Exterior Aluminum Windows:

    a. Kawneer: Trifab VG 451 T
    b. EFCO: System 403.
    c. Tubelite:
    d. Vistawall: 3000 Thermal MultiPlane
    e. YKK AP: YES 45 TU.

4. Doors and Entrances:

    a. Kawneer: 350 Heavy Wall.
    b. EFCO: Series D318 DuraStile.
    c. Tubelite: Medium Stile Entrance.
    d. Vistawall: Rugged MS.
    e. YKK AP: 40D HD Entrance Door.

C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's standard, extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction:

    a. Exterior: Thermally broken
    b. Interior: Nonthermal.

2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Exterior Jambs and Head Framing: Provide manufacturer’s standard extruded aluminum continuous flat filler for use at jambs and head framing. This extrusion provides the necessary profile for sealing with the building air barrier system. Channel type jamb components will not be acceptable.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Subsills for Exterior Storefronts: Manufacturer's standard thermally broken extruded aluminum sill flashing, color to match framing.

E. Subframes: Provide "F"-Stop subframes with anchors for window units as shown, of profile and dimensions required but not less than 0.062-inch- thick extruded aluminum. Miter or cope corners and finish to match window units. Provide subframes capable of withstanding design loads of window units.

F. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 INSULATED SPANDREL PANELS

A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

1. Overall Panel Thickness: 1 inch.
2. Exterior and Interior Skin: Aluminum.

   a. Thickness: Manufacturer's standard for finish and texture indicated.
   b. Finish: Match framing system.
   c. Texture: Smooth.
   d. Backing Sheet: 1/8-inch- thick, tempered hardboard.

3. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3-1/2-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

C. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.7 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

B. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

C. Exposed Flashing: Where indicated, provide .040 inch thick aluminum, finished to match storefront. Provide at window sills, column covers and elsewhere in contact with the storefront perimeters.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior and interior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 088000 "Glazing."

F. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084113

SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazed aluminum curtain walls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.

3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Mockup Testing Submittals:

1. Testing Program: Developed specifically for Project.
2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.

B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

D. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: One year from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Basic Wind Speed: 100 mph.
    b. Importance Factor: 1.15.
    c. Exposure Category: B.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

    a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4-inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft..

2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.
2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.7 at design displacement and 1.5 times the design displacement.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.63 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 66 for frame as determined according to AAMA 1503.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Reliance Wall by Oldcastle, Inc. or comparable product by one of the following:

1. Kawneer North America.
2. Tubelite.

B. Source Limitations: Obtain all components of curtain wall system, including framing spandrel panels and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.

4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

E. Column Cover: To match curtain wall mullion sections in material and finish.

2.4 INSULATED SPANDREL PANELS

A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.

1. Overall Panel Thickness: 1 inch.
2. Exterior and Interior Skin: Aluminum.

a. Thickness: Manufacturer's standard for finish and texture indicated.
b. Finish: Match framing system.
c. Texture: Smooth.
d. Backing Sheet: 1/8-inch- thick, tempered hardboard.

3. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.5 ENTRANCES

A. Entrances: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts."

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Components curved to indicated radii.

D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
3. Preparation includes, but is not limited to, cleaning and priming surfaces.
4. Seal joints watertight unless otherwise indicated.
5. Install glazing to comply with requirements in Section 088000 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.

b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 084413

Reliance™ Curtain Wall System—a new high-performing, pressure-equalized curtain wall system from Oldcastle BuildingEnvelope™

Reliance™ Wall zone-glazed system is easy to install and features **exceptional water control** and outstanding thermal performance. Reliance™ Wall is offered as a 1" infill system, with snap-in adapters to accommodate 1/4" infill for spandrel applications, as well as a complete 1/4" infill system. The system provides two gasket options: The standard option utilizes an EPDM dense gasket for both the exterior and interior applications. A second option features an EPDM dense gasket for the exterior and an EPDM sponge gasket for the interior to accommodate molded corners when necessary. Other installation features include **roll-over and roll-under horizontals** to simplify typical field stick erection. Reliance™ Wall is thermally broken utilizing an EPDM push-in thermal isolator. The system includes **thermally improved** door framing adapters, which can accommodate the use of our Thermal Entrances to complete a thermal elevation.

RadioShack Riverfront Campus, Fort Worth, TX
Architect: HKS, Inc.

Performance

- Air Infiltration: <.06 CFM/SQ FT (6.24 PSF) per ASTM E283
- Static Water: 15 PSF per ASTM E331
- Dynamic Water: 15 PSF per AAMA 501.1
- Deflection Load: 40 PSF per ASTM E330
- Structural Load: 60 PSF per ASTM E330
- STC: 33 (1/4"–1/2"–1/4" glazing)
  37 (1/4" laminated –1/2"–1/4" laminated glazing)
  per ASTM E90
- Seismic: Three levels of displacement per AAMA 501.4
- Thermal Performance per AAMA 1503 for clear 1" insulating glass:
  – U-Value = 0.63
  – CRF frame = 66
- NFRC Certified
- Thermal Performance Characteristics per AAMA 507

Reliance™ curtain wall system

Reliance™ curtain wall system

Granite Park III, Plano, TX
Architect: BOKA Powell

Precision Engineered

- Value engineered for efficient use of material
- Easy to install
- Use of common members to reduce construction errors and costs and to simplify site fabrication
- Factory-punched pressure plates
- Self-drilling pressure plate screws
- Precision injection molded zone plugs for frame member intersections

Design Flexibility

- Reliance™ allows the specifier numerous options, such as various loading capabilities, extensive finishing alternatives, one- and two-piece horizontal mullions
- 2-1/2" sightline and multiple system depths for structural as well as aesthetic requirements
- Heavy-duty vertical mullions are available for higher design criteria
- Reliance offers a complete system to accommodate 1" or 1/4" vision or spandrel glazing
- No exposed fasteners that will take away from appearance
- Aesthetic flexibility
- Can be installed using either captured or structural silicone-glazed vertical mullions
- Low-profile corner mullions
- Superior thermal performance, utilizing innovative door framing components that are thermally improved
- Accommodates glazed-in operable vents
- Optional head member to accommodate incidental water
- Integration of our Solar Eclipse™ and Solar Shelf™ sun control products, offering a wide range of engineered designs

Oldcastle BuildingEnvelope™

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1-866-OLDCASTLE (653-2278) ▪ oldcastlebe.com

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Glazed curtain walls.
3. Storefront framing.
4. Glazed entrances.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2003 International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

a. Basic Wind Speed: 100 mph.
b. Importance Factor: 1.15.
c. Exposure Category: B.

2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass.

C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to

manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

C. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.

1. Basis-of-Design Product: To be determined.

2.3 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with silicone primary seal and butyl secondary seal.
2. Spacer: Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. May National Associates, Inc.; Bondaflex Sil 290.
d. Pecora Corporation; 890.
e. Sika Corporation, Construction Products Division; SikaSil-C990.
f. Tremco Incorporated; Spectrem 1.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.9 INSULATING-GLASS TYPES

A. Insulated Glass: Clear insulating glass.

1. Overall Unit Thickness: 5/8 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass.
4. Interspace Content: Air.
5. Indoor Lite: Float glass.
6. Provide tempered glass and safety glazing labeling where required by code.
7. Application: Exterior hollow metal doors and sidelites.

B. Low-E Insulated Glass: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass.
4. Interspace Content: Air.
5. Indoor Lite: Float glass.
6. Low-E Coating: Pyrolytic or sputtered on second or third surface.
7. Provide tempered glass and safety glazing labeling where required by code.
8. Application: Exterior storefronts, curtain walls and entrances.

C. Insulated Spandrel Glass: Ceramic-coated, insulating spandrel glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Air.
5. Indoor Lite: Fully tempered float glass.
6. Coating Location: Fourth surface.
7. Winter Nighttime U-Factor: <**Insert value**> maximum.
8. Summer Daytime U-Factor: <**Insert value**> maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in

position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

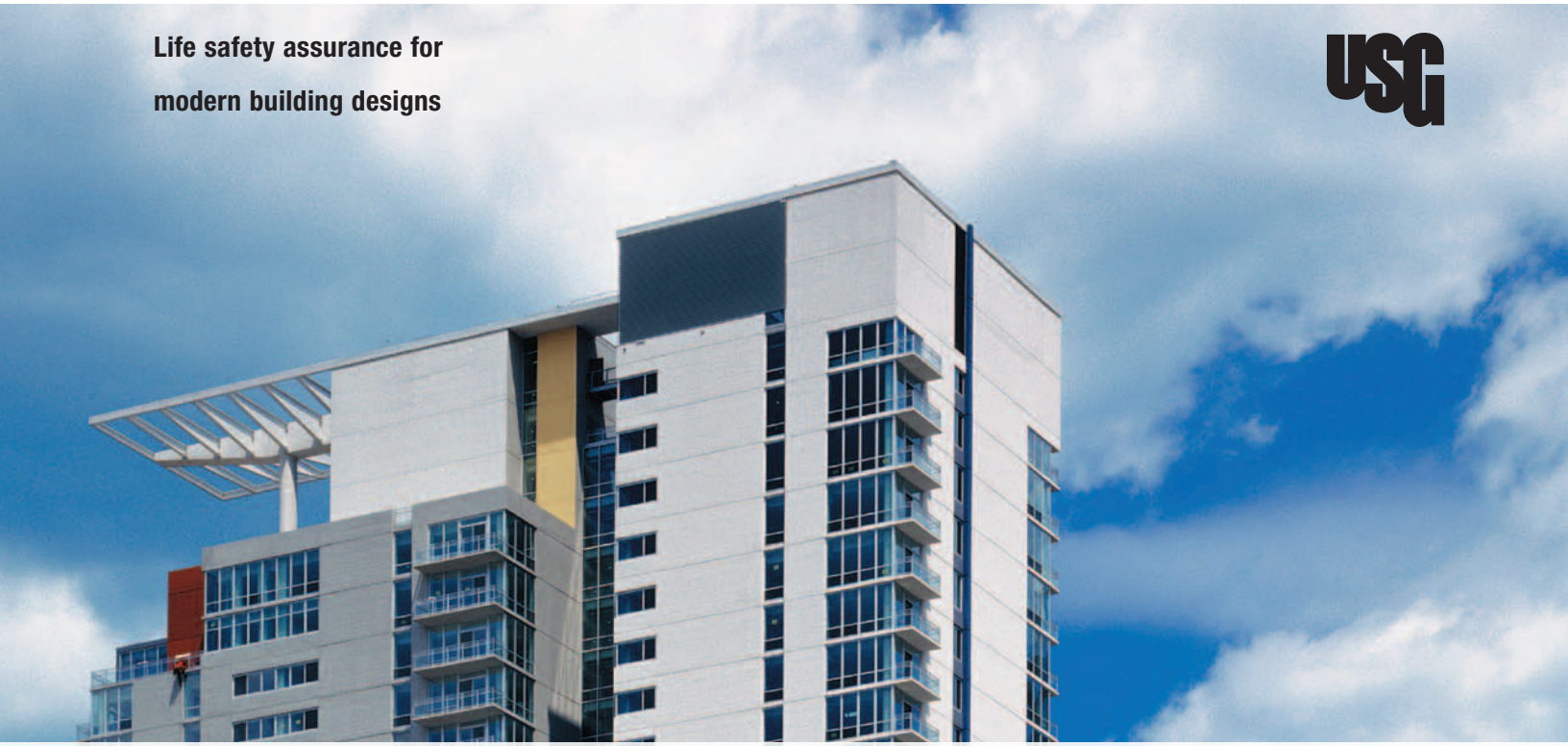
D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

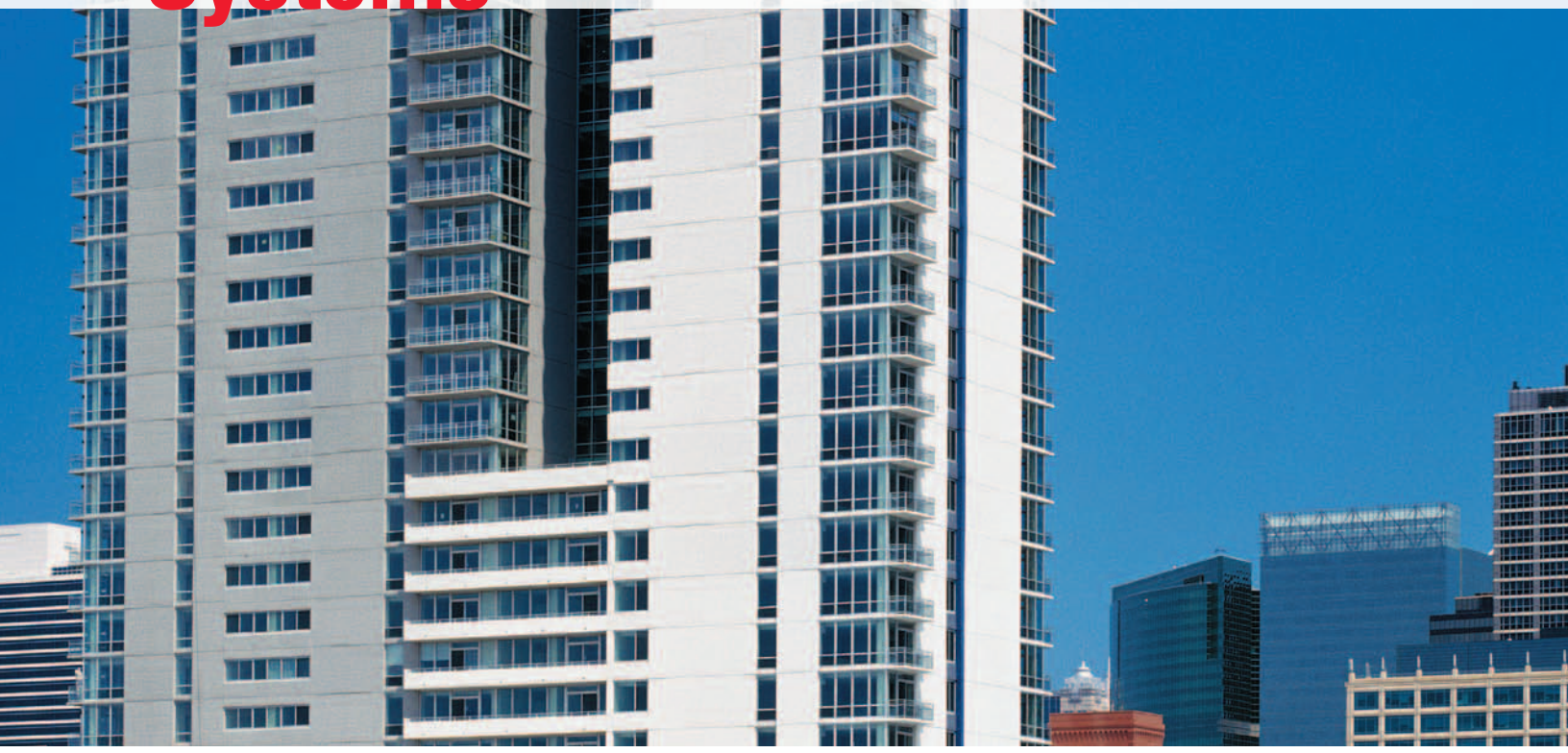
END OF SECTION 088000

Life safety assurance for
modern building designs

USG



Shaft Wall
Systems



Components

USG shaft wall systems have been comprehensively tested for fire resistance ratings only when all of the system components are used together. Substitutions of any of the components are not recommended and are not supported by USG. Refer to the appropriate product material safety data sheet for complete health and safety information.

Gypsum Liner Panels

SHEETROCK® Brand Gypsum Liner Panels

- High-performance panels have a noncombustible core encased in a water-resistant 100% recycled green face and back paper
- Underwriters Laboratories (UL)/Underwriters Laboratories Canada (ULC) Classified for fire resistance
- Panels are 1" thick and 24" wide with beveled edges
- Refer to product submittal sheet WB2278 for more information

SHEETROCK® Brand MOLD TOUGH™ Gypsum Liner Panels

- High-performance panels have a noncombustible and moisture- and mold-resistant gypsum core enclosed in a moisture- and mold-resistant, 100% recycled blue face and back paper
- UL/ULC Classified as to fire resistance
- Panels are 1" thick and 24" wide with beveled edges
- Refer to product submittal sheet WB2389 for more information

SHEETROCK® Brand Glass-Mat Liner Panels

- High-performance panels have a noncombustible and moisture- and mold-resistant gypsum core enclosed in a moisture- and mold-resistant glass mat on both sides
- Can be left exposed for up to 12 months
- UL/ULC classified as to fire resistance
- Panels are 1" thick and 24" wide with beveled edges
- Refer to product submittal sheet WB2483 for more information

Gypsum Panels and Cement Board

SHEETROCK® Brand FIRECODE® Core Gypsum Panels

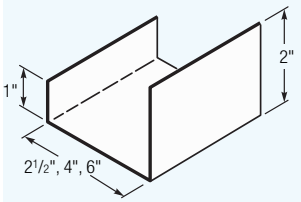
- All of the advantages of regular panels with additional resistance to fire
- Available in 5/8" thickness, 4' width
- Refer to product submittal sheet WB1473 for more information

SHEETROCK® Brand FIRECODE® C Core Gypsum Panels

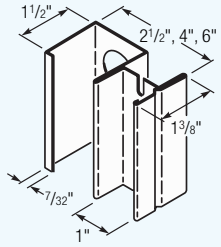
- Provide improved fire resistance over standard FIRECODE panels because of additives that enhance integrity of the core under fire exposure
- Available in 5/8" and 1/2" thicknesses, 4' width
- Refer to product submittal sheet WB1473 for more information

Steel Framing

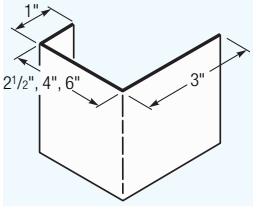
USG Steel J-Runner (JR)



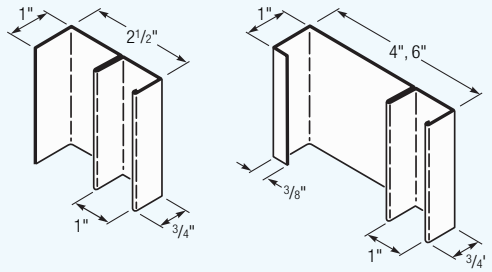
USG Steel C-H Stud (CH)



USG Steel Jamb-Strut (JS)



USG Steel E-Stud (ES)



Thickness–Steel Framing[a] Components

	Design Thickness[b]		Minimum Thickness		
Style	**in.**	**mils**	**in.**	**mils**	**ga.**
CH, ES	0.0188	18	0.0179	18	25
JR	0.0239	22	0.0227	23	24
CH, ES, JR, JS	0.0359	33	0.0341	34	20

Structural Properties–Steel Framing Components

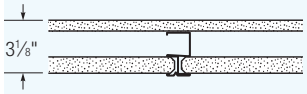
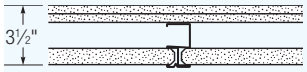
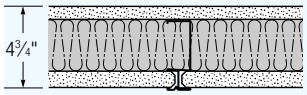
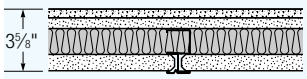
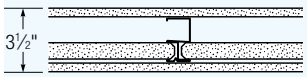
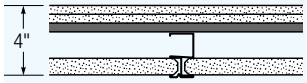
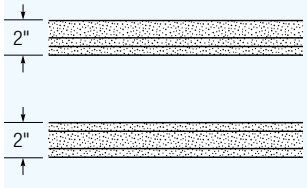
Component and Size	Product Identification	Average Weight (lb./lin. ft.)	Area (sq. in.)	I_x (in.4)	S_x[c] (cu. in.)	Allowance Design Stress (ksi)
2-1/2" C-H Stud	212CH-18	0.5186	0.1524	0.129	0.093	19.8
	212CH-34	0.998	0.2910	0.239	0.1741	24.0
4" C-H Stud	400CH-18	0.6118	0.1798	0.383	0.162	19.8
	400CH-34	1.243	0.3433	0.730	0.318	24.0
6" C-H Stud	600CH-34	1.366	0.4227	1.998	0.569	24.0
Double 6" E-Stud	600ES-18	1.546	0.3982	2.004	0.628	20.00
	600ES-34	2.372	0.6364	3.400	1.094	20.00
2-1/2" J-Runner	212JR-23	0.448	0.1346	0.117	0.085	3.00
	212JR-34	0.670	0.2039	0.192	0.130	4.96
4" J-Runner	400JR-23	0.573	0.1705	0.351	0.163	3.00
	400JR-34	0.857	0.2577	0.574	0.251	4.96
6" J-Runner	600JR-23	0.740	0.2183	0.937	0.295	3.00
	600JR-34	1.107	0.3295	1.523	0.457	4.96
2-1/2" Jamb Strut	212JS-34	0.818	0.2398	0.226	0.143	3.00
4" Jamb Strut	400JS-34	1.006	0.2936	0.647	0.270	3.00
6" Jamb Strut	600JS-34	1.256	0.3654	1.673	0.485	3.00

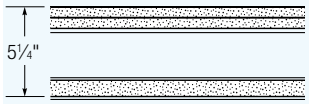
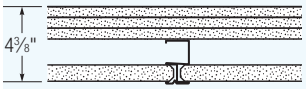
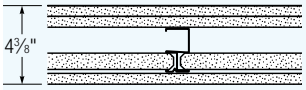
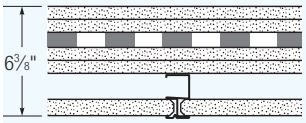
Note

(a) Studs and runners comply with ASTM C645. (b) Properties of steel framing members have been calculated in conformance with ANSI Specification for the Design of Cold-Formed Steel Structural Members, 1996 edition. (c) Full section modulus to be used with corresponding design stress.

Performance Selector

All details, specifications, and data contained in this literature are intended as a general guide. These products must not be used in a design or construction of any given structure without complete and detailed evaluation by a qualified structural engineer or architect to verify suitability of a particular product for use in the structure.

1-Hour Fire-rated Construction	Non-loadbearing		Acoustical Performance		Reference	
Construction Detail	**Description**	**Test Number**	**STC**	**Test Number**	**ARL**	**Index**
wt. 8  3⅛"	• 5/8" SHEETROCK FIRECODE Core gypsum panels, joints finished • 2-1/2" USG C-H Studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels	**UL Des U415, System A** or **U469**	39	**USG-040901** Based on 4" C-H studs 25 gauge	SA926	**1**
2-Hour Fire-rated Construction						
wt. 9  3½"	• 1/2" SHEETROCK FIRECODE C Core gypsum panels, face layer joints finished • 2-1/2" USG C-H Studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels	**UL Des U415, System B** or **U438**	38	**USG-040917**	SA926	**2**
			43	**USG-040912** Based on 4" C-H studs 25 gauge		
			48	**RAL-OT-04-022** Based on 1" sound batts in cavity		
			50	**RAL-OT-04-019** Based on 4" C-H studs 25 gauge with 3" mineral fiber insulation		
wt. 8  4¾"	• 3/4" SHEETROCK ULTRACODE Core gypsum panels, joints finished • 4" USG C-H studs 25 gauge 24" o.c. • 3" THERMAFIBER SAFB • 1" SHEETROCK gypsum liner panels	**UL Des U415, System C**	51	**RAL-OT-04-020** Based on 4" C-H studs with 3" THERMAFIBER SAFB insulation	SA926	**3**
wt. 10  3⅝"	• 1/2" DUROCK cement board, joints finished • 5/8" SHEETROCK FIRECODE Core gypsum panels • 2-1/2" USG C-H studs 20 gauge 24" o.c. • 1-1/2" THERMAFIBER SAFB • 1" SHEETROCK gypsum liner panels • DUROCK cement board, screw attached and laminated to gypsum panel with 4 vertical strip ceramic tile mastic centered between studs	**UL Des U415, System D**			SA926	**4**
wt. 9  3½"	• 1/2" SHEETROCK FIRECODE C Core gypsum panels • 2-1/2" USG C-H Studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels – joints finished both sides	**UL Des U415, System E** or **U467**	44	**USG-040911** Based on 4" C-H studs 25 gauge	SA926	**5**
wt. 10  4"	• 1/2" SHEETROCK FIRECODE C Core gypsum panels applied vertically, face layer joints finished • RC-1 resilient channel or equivalent 24" o.c. • 2-1/2" USG C-H Studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels	**UL Des U415, System F**	53	**USG-040909** Based on 4" C-H studs 25 gauge with 3" mineral fiber insulation	SA926	**6**
			58	**USG-040910** Based on 4" C-H studs 25 gauge with additional layer on liner panel side and 3" mineral fiber insulation		
wt. 8  2" 2"	• 1" x 2" perimeter angles 25 gauge • 1" SHEETROCK gypsum liner panel, fastened to angles • 1/2" SHEETROCK FIRECODE C Core gypsum panels • 1/2" SHEETROCK FIRECODE C Core gypsum panels, joints finished	**UL Des U529**			SA926	**7**

2-Hour Fire-rated Construction	Non-loadbearing		Acoustical Performance		Reference	
Construction Detail	**Description**	**Test Number**	**STC**	**Test Number**	**ARL**	**Index**
	• 5/8" SHEETROCK FIRECODE Core gypsum panels, face layer joints finished • 4" USG C-H studs 20 gauge 24" o.c. run horizontally and attached to vertical USG J-runners, 20 gauge • 1" SHEETROCK gypsum liner panels	**UL Des U437**			SA926	**8**
3-Hour Fire-rated Construction						
wt. 13 	• 5/8" SHEETROCK FIRECODE C Core gypsum panels, face layer joints finished • 2-1/2" USG C-H studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels	**UL Des U415, System G**			SA926	**9**
wt. 13 	• 5/8" SHEETROCK FIRECODE C Core gypsum panels, face layer joints finished • 2-1/2" USG C-H studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels • 5/8" SHEETROCK FIRECODE C Core gypsum panels, joints finished	**UL Des U415, System H**	49	**USG-040902** Based on 4" C-H Studs	SA926	**10**
4-Hour Fire-rated Construction						
wt. 18 	• 3/4" SHEETROCK ULTRACODE Core gypsum panels, on furring channel 24" o.c., over 2 layers 3/4" SHEETROCK ULTRACODE Core gypsum panels, face layer joints finished • 2-1/2" USG C-H studs 25 gauge 24" o.c. • 1" SHEETROCK gypsum liner panels • base layer over furring channel applied vertically **Note:** Stud size and gauge shown are minimums. Possible panels substitutions. **Note** Stud size and gauge shown are minimums. Possible panel alternatives shown on cross reference of USG Panels and UI Fire Ratings on page 7 of SA100, *Fire-Resistant Assemblies*.	**UL Des U415, System I**			SA926	**11**

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Metric Specifications
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USG

Manufactured by
United States Gypsum Company
550 West Adams Street
Chicago, IL 60661

SA926/rev. 5-10

SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: As indicated.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: As indicated.
2. Minimum Base-Metal Thickness: 0.033 inch.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: 0.033 inch.

E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

F. Room-Side Finish: As indicated.

G. Shaft-Side Finish: As indicated.

H. Insulation: Sound attenuation blankets.

2.3 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; ProRoc Shaftliner.
b. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
c. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.

e. PABCO Gypsum; Pabcore Shaftliner Type X.
f. Temple-Inland Inc.; Fire-Rated SilentGuard Gypsum Shaftliner System.
g. USG Corporation; Sheetrock Brand Gypsum Liner Panel.

2. Thickness: 1 inch.
3. Long Edges: Double bevel.

C. Gypsum Board: As specified in Section 092900 "Gypsum Board."

2.4 NON-LOAD-BEARING STEEL FRAMING

A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak System.
b. Metal-Lite, Inc.; The System.
c. Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."

F. Acoustical Sealant: As specified in Section 092900 "Gypsum Board."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 16 gage minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.018 inch for furring and framing for soffits, 0.027 inch for wall framing and 0.033 inch for fire fire-rated wall framing.
b. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
2) MBA Building Supplies; FlatSteel Deflection Track or Slotted Deflecto Track.
3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
4) Superior Metal Trim; Superior Flex Track System (SFT).
5) Telling Industries; Vertical Slip Track or Vertical Slip Track II.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dietrich: SLP-TRK Slotted Track.
b. Fire Trak Corp.; Fire Trak.
c. Metal-Lite, Inc.; The System.
d. The Steel Network, Inc.; VertiClip SLD or VertiTrack VTD.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 18 gage.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch.
2. Depth: 7/8 inch.

H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.018 inch.
b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.018 inch.

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two 0.312 inch (0.79 mm) (20 gage) studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

D. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

ProSTUD® PRODUCT CATALOG

ClarkDietrich
BUILDING SYSTEMS

DRYWALL FRAMING SYSTEM

CONSTRUCTION ADVANTAGES

- High-strength steel combined with low-profile flange stiffening grooves and double offset web planking increases strength and provides greater limiting heights
- Diamond embossed web creates stiffness, reducing flange fade and screw spinout during drywall installation
- Strong, lightweight stud and track cuts and handles easier than conventional flat steel studs
- Flange grooves provide sight line for drywall alignment and aid in positioning screws at drywall joints to maintain the 3/8"edge requirement
- Web and leg enhancements in ProTRAK® provide straight and rigid legs, making it the best choice for framing walls, headers, soffits, and bulkheads

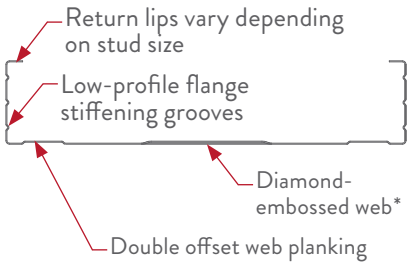
DESIGN ADVANTAGES

- Designed to meet the additional strength requirements of today's building codes: IBC 2003, 2006 & 2009, AISI NASPEC (S100), ICC-ES AC86 (2010)
- UL Classified and listed in over 50 designs, including U419, V438, and chase wall assemblies
- Exceptional sound performance in over 50 tested sound assemblies
- Can contribute up to 7 LEED® Credits under LEED for New Construction and Major Renovations (LEED-NC Ver. 2.2 and 3.0)
- National availability

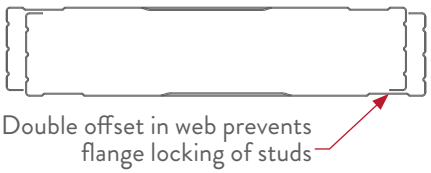
ProSTUD®

- Web Widths: **1-5/8," 2-1/2,"** 3-1/2," **3-5/8," 4,"** 5-1/2," and **6"**
- Flange: 1-1/4"
- Return Lip: varies by stud size
- **Standard Material Thicknesses:**
  ProSTUD 25 / 15mil (25ga EQ) 50ksi
  ProSTUD 20 / 19mil (20ga EQ) 65ksi
- Non-Standard Material Thicknesses:
  ProSTUD 20XD / 22mil (20ga EQ) 57ksi
  ProSTUD 30MIL 33ksi
  ProSTUD 33MIL 33ksi
- All material G40 EQ (CP60 available as special order)

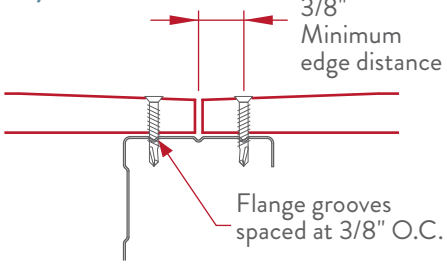
ProSTUD Profile



Shipping / Stacking

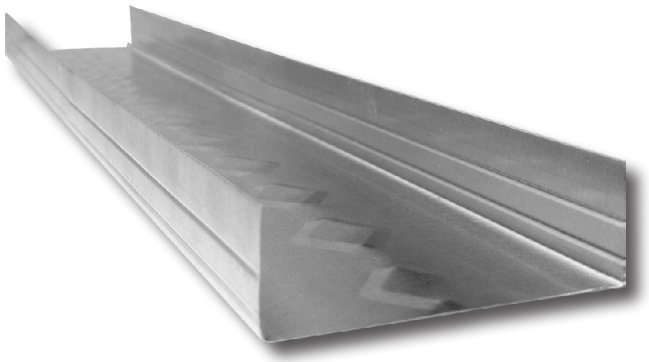


Drywall Joint



*Except in 1-5/8"

ProTRAK



- Web Widths: **1-5/8," 2-1/2,"** 3-1/2," **3-5/8," 4,"** 5-1/2," and **6"**
- Legs: 1," **1-1/4,"** 1-1/2," 2," 2-1/2," and 3"
- **Standard Material Thicknesses:**
  ProTRAK 25 / 15mil (25ga EQ) 50ksi
  ProTRAK 20 / 19mil (20ga EQ) 50ksi
- Non-Standard Material Thicknesses:
  ProTRAK 20XD / 22mil (20ga EQ) 50ksi
  ProTRAK 30MIL 33ksi
  ProTRAK 33MIL 33ksi
- All material G40 EQ (CP60 available as special order)

The technical content of this literature is effective 3/23/12 and supersedes all previous information.
Pub. No. CD-ProSTUD-East 3/12

ProSTUD® 25 DRYWALL STUD

ClarkDietrich ProSTUD 25 (15mil) physical and structural properties

Member	Design thickness (in)	Fy (ksi)	Gross Section Properties						Effective Section Properties at Fy						Torsional Properties					Lu (in)
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ae (in^2)	Ix (in^4)	Sx (in^3)	Ma (in-lbs)	Vag (lb)	Vanet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	Ro (in)	β Beta	
162PDS125-15	0.0158	50	0.071	0.24	0.033	0.688	0.015	0.466	0.033	0.030	0.024	719	232	104	0.00589	0.009	-1.088	1.369	0.368	24.8
250PDS125-15	0.0158	50	0.085	0.29	0.088	1.020	0.018	0.459	0.033	0.080	0.044	1198	147	141	0.00704	0.023	-0.959	1.473	0.576	24.5
362PDS125-15[1]	0.0158	50	0.102	0.35	0.206	1.420	0.020	0.442	0.034	0.190	0.056	1689	100	100	0.00852	0.051	-0.837	1.706	0.760	24.3
400PDS125-15[1]	0.0158	50	0.108	0.37	0.260	1.549	0.021	0.436	0.034	0.233	0.062	1870	90	90	0.00901	0.064	-0.803	1.798	0.800	24.2
600PDS125-15[2]	0.0158	50	0.140	0.48	0.683	2.209	0.023	0.404	0.034	0.537	0.105	2781	60	60	0.01164	0.161	-0.666	2.343	0.919	23.6

ProTRAK® 25 DRYWALL TRACK

ClarkDietrich ProTRAK 25 (15mil) physical and structural properties

Member	Design thickness (in)	Fy (ksi)	Gross Section Properties						Effective Section Properties at Fy					Torsional Properties				
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ae (in^2)	Ix (in^4)	Sx (in^3)	Ma (in-lbs)	Vag (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	Ro (in)	β Beta
162PDT125-15	0.0158	50	0.065	0.22	0.034	0.717	0.011	0.412	0.020	0.021	0.016	464	222	0.00542	0.006	-0.881	1.208	0.468
250PDT125-15	0.0158	50	0.079	0.27	0.085	1.038	0.013	0.400	0.020	0.059	0.024	724	143	0.00657	0.015	-0.771	1.353	0.675
362PDT125-15[1]	0.0158	50	0.097	0.33	0.196	1.425	0.014	0.381	0.021	0.125	0.035	1059	98	0.00805	0.034	-0.668	1.619	0.830
400PDT125-15[1]	0.0158	50	0.103	0.35	0.247	1.550	0.014	0.374	0.021	0.153	0.039	1171	89	0.00854	0.043	-0.640	1.718	0.861
600PDT125-15[2]	0.0158	50	0.134	0.46	0.646	2.194	0.016	0.343	0.021	0.350	0.059	1762	59	0.01117	0.108	-0.524	2.282	0.947
162PDT200-15	0.0158	50	0.089	0.30	0.050	0.752	0.039	0.663	0.020	0.025	0.015	455	222	0.00739	0.020	-1.579	1.870	0.287
250PDT200-15	0.0158	50	0.103	0.35	0.124	1.098	0.045	0.662	0.021	0.064	0.024	720	143	0.00854	0.052	-1.431	1.921	0.445
362PDT200-15[1]	0.0158	50	0.120	0.41	0.277	1.516	0.051	0.648	0.021	0.137	0.036	1063	98	0.01002	0.120	-1.282	2.088	0.623
400PDT200-15[1]	0.0158	50	0.126	0.43	0.344	1.650	0.052	0.642	0.021	0.168	0.039	1178	89	0.01052	0.151	-1.240	2.162	0.671
600PDT200-15[2]	0.0158	50	0.158	0.54	0.864	2.338	0.058	0.608	0.021	0.389	0.060	1789	59	0.01315	0.383	-1.058	2.638	0.839
162PDT250-15	0.0158	50	0.105	0.36	0.061	0.766	0.071	0.824	0.020	0.027	0.015	455	222	0.00871	0.038	-2.058	2.345	0.230
250PDT250-15	0.0158	50	0.118	0.40	0.150	1.123	0.082	0.831	0.021	0.066	0.024	725	143	0.00986	0.096	-1.892	2.352	0.353
362PDT250-15[1]	0.0158	50	0.136	0.46	0.330	1.557	0.092	0.823	0.021	0.142	0.036	1073	98	0.01134	0.220	-1.720	2.462	0.512
400PDT250-15[1]	0.0158	50	0.142	0.48	0.409	1.696	0.095	0.819	0.021	0.174	0.040	1189	89	0.01183	0.275	-1.670	2.517	0.560
600PDT250-15[2]	0.0158	50	0.174	0.59	1.009	2.409	0.108	0.787	0.021	0.404	0.060	1809	59	0.01446	0.697	-1.452	2.921	0.753

Notes:

- Calculated properties are based on AISI S100-07, North American Specification for Design of Cold-Formed Steel Structural Members.
- Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI A7.2.
- Tabulated gross properties, including torsional properties, are based on full-unreduced cross section of the studs, away from punchouts.
- Tabulated gross properties, including torsional properties, are based on full-unreduced cross section of the tracks.
- For deflection calculations, use the effective moment of inertia.
- Allowable moment includes cold work of forming.
- Allowable moment is taken as the lowest value based on local or distortional buckling. Distortional buckling strength is based on a k-phi = 0.
- Web depth for track sections is equal to the nominal height plus two times the design thickness plus the bend radius. Hems on non-structural track sections are ignored.

1 Web-height to thickness ratio exceeds 200. Web stiffeners are required at bearing points.

2 Web-height to thickness ratio exceeds 260. Web stiffeners are required at bearing and intermediate points.

ProSTUD® 20 DRYWALL STUD

ClarkDietrich ProSTUD 20 (19mil) physical and structural properties

Member	Design thickness (in)	Fy (ksi)	Gross Section Properties						Effective Section Properties at Fy						Torsional Properties					Lu (in)
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ae (in^2)	Ix (in^4)	Sx (in^3)	Ma (in-lbs)	Vag (lb)	Vanet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	Ro (in)	β Beta	
162PDS125-19	0.0200	65	0.090	0.31	0.042	0.685	0.020	0.466	0.042	0.037	0.031	1193	473	165	0.01197	0.012	-1.096	1.374	0.364	22.0
250PDS125-19	0.0200	65	0.109	0.37	0.112	1.017	0.024	0.467	0.046	0.104	0.061	2110	299	226	0.01449	0.032	-0.992	1.495	0.560	22.2
362PDS125-19	0.0200	65	0.132	0.45	0.266	1.420	0.027	0.454	0.048	0.254	0.080	3103	203	189	0.01757	0.072	-0.876	1.729	0.743	22.1
400PDS125-19	0.0200	65	0.140	0.48	0.336	1.550	0.028	0.451	0.050	0.316	0.091	3537	184	184	0.01865	0.092	-0.851	1.825	0.783	22.2
600PDS125-19[2]	0.0200	65	0.181	0.62	0.892	2.220	0.033	0.425	0.051	0.727	0.158	5421	121	121	0.02414	0.236	-0.723	2.373	0.907	21.9

ProTRAK® 20 DRYWALL TRACK

ClarkDietrich ProTRAK 20 (19mil) physical and structural properties

Member	Design thickness (in)	Fy (ksi)	Gross Section Properties						Effective Section Properties at Fy					Torsional Properties				
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ae (in^2)	Ix (in^4)	Sx (in^3)	Ma (in-lbs)	Vag (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	Ro (in)	β Beta
162PDT125-19	0.0200	50	0.082	0.28	0.043	0.719	0.014	0.411	0.031	0.028	0.024	718	421	0.01099	0.007	-0.879	1.207	0.470
250PDT125-19	0.0200	50	0.100	0.34	0.108	1.039	0.016	0.400	0.032	0.078	0.038	1136	289	0.01333	0.018	-0.769	1.353	0.677
362PDT125-19	0.0200	50	0.122	0.42	0.249	1.426	0.018	0.380	0.032	0.191	0.055	1650	199	0.01633	0.043	-0.666	1.619	0.831
400PDT125-19	0.0200	50	0.130	0.44	0.312	1.551	0.018	0.374	0.032	0.232	0.061	1822	180	0.01733	0.054	-0.638	1.718	0.862
600PDT125-19[2]	0.0200	50	0.170	0.58	0.819	2.195	0.020	0.342	0.032	0.508	0.091	2717	119	0.02266	0.137	-0.523	2.282	0.948
162PDT200-19	0.0200	50	0.112	0.38	0.064	0.754	0.049	0.662	0.031	0.034	0.024	707	421	0.01499	0.026	-1.576	1.868	0.288
250PDT200-19	0.0200	50	0.130	0.44	0.157	1.099	0.057	0.661	0.032	0.094	0.037	1119	289	0.01733	0.066	-1.429	1.920	0.446
362PDT200-19	0.0200	50	0.152	0.52	0.351	1.517	0.064	0.647	0.032	0.205	0.055	1651	199	0.02033	0.152	-1.280	2.088	0.624
400PDT200-19	0.0200	50	0.160	0.54	0.436	1.651	0.066	0.642	0.032	0.251	0.061	1829	180	0.02133	0.191	-1.238	2.161	0.672
600PDT200-19[2]	0.0200	50	0.200	0.68	1.094	2.339	0.074	0.607	0.033	0.580	0.093	2780	119	0.02666	0.485	-1.056	2.637	0.840
162PDT250-19	0.0200	50	0.132	0.45	0.078	0.768	0.090	0.823	0.031	0.037	0.023	698	421	0.01766	0.048	-2.055	2.343	0.231
250PDT250-19	0.0200	50	0.150	0.51	0.190	1.125	0.103	0.830	0.032	0.099	0.037	1113	289	0.01999	0.121	-1.890	2.351	0.354
362PDT250-19	0.0200	50	0.172	0.59	0.419	1.558	0.117	0.822	0.032	0.213	0.055	1649	199	0.02299	0.278	-1.718	2.461	0.513
400PDT250-19	0.0200	50	0.180	0.61	0.518	1.697	0.120	0.818	0.032	0.261	0.061	1829	180	0.02399	0.348	-1.668	2.517	0.561
600PDT250-19[2]	0.0200	50	0.220	0.75	1.278	2.410	0.136	0.786	0.033	0.605	0.093	2788	119	0.02933	0.881	-1.450	2.920	0.754

Notes:

- Calculated properties are based on AISI S100-07, North American Specification for Design of Cold-Formed Steel Structural Members.
- Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI A7.2.
- Tabulated gross properties, including torsional properties, are based on full-unreduced cross section of the studs, away from punchouts.
- Tabulated gross properties, including torsional properties, are based on full-unreduced cross section of the tracks.
- For deflection calculations, use the effective moment of inertia.
- Allowable moment includes cold work of forming.
- Allowable moment is taken as the lowest value based on local or distortional buckling. Distortional buckling strength is based on a k-phi = 0.
- Web depth for track sections is equal to the nominal height plus two times the design thickness plus the bend radius. Hems on non-structural track sections are ignored.

1 Web-height to thickness ratio exceeds 200. Web stiffeners are required at bearing points.

2 Web-height to thickness ratio exceeds 260. Web stiffeners are required at bearing and intermediate points.

The technical content of this literature is effective 3/23/12 and supersedes all previous information.

Pub. No. CD-ProSTUD-East 3/12

ProSTUD® 20XD DRYWALL STUD (AVAILABLE IN SELECT MARKETS)

ClarkDietrich ProSTUD 20XD (22mil) physical and structural properties

Member	Design thickness (in)	Fy (ksi)	Gross Section Properties						Effective Section Properties at Fy						Torsional Properties					Lu (in)
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ae (in^2)	Ix (in^4)	Sx (in^3)	Ma (in-lbs)	Vag (lb)	Vanet (lb)	J*1000 (in^4)	Cw (in^6)	Xo (in)	Ro (in)	β Beta	
162PDS125-22	0.0232	57	0.103	0.35	0.048	0.685	0.022	0.462	0.053	0.044	0.038	1302	605	181	0.01850	0.013	-1.079	1.359	0.369	23.2
250PDS125-22	0.0232	57	0.123	0.42	0.127	1.016	0.026	0.455	0.055	0.115	0.075	2226	468	303	0.02214	0.033	-0.950	1.464	0.579	22.9
362PDS125-22	0.0232	57	0.149	0.51	0.300	1.416	0.029	0.438	0.055	0.279	0.091	3121	318	253	0.02682	0.074	-0.828	1.698	0.762	22.7
400PDS125-22	0.0232	57	0.158	0.54	0.377	1.544	0.030	0.432	0.055	0.353	0.101	3459	287	272	0.02838	0.092	-0.795	1.790	0.803	22.6
600PDS125-22[1]	0.0232	57	0.205	0.70	0.997	2.205	0.033	0.402	0.056	0.830	0.178	5404	189	189	0.03676	0.233	-0.662	2.337	0.920	22.1

ProTRAK® 20XD DRYWALL TRACK

ClarkDietrich ProTRAK 20XD (22mil) physical and structural properties

Member	Design thickness (in)	Fy (ksi)	Gross Section Properties						Effective Section Properties at Fy					Torsional Properties				
			Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ae (in^2)	Ix (in^4)	Sx (in^3)	Ma (in-lbs)	Vag (lb)	J*1000 (in^4)	Cw (in^6)	Xo (in)	Ro (in)	β Beta
162PDT125-22	0.0232	50	0.096	0.33	0.050	0.720	0.016	0.411	0.040	0.034	0.029	877	566	0.01715	0.008	-0.877	1.206	0.472
250PDT125-22	0.0232	50	0.116	0.39	0.125	1.040	0.018	0.399	0.041	0.092	0.051	1525	452	0.02079	0.021	-0.767	1.352	0.678
362PDT125-22	0.0232	50	0.142	0.48	0.290	1.428	0.020	0.379	0.042	0.228	0.073	2197	310	0.02549	0.050	-0.664	1.620	0.832
400PDT125-22	0.0232	50	0.151	0.51	0.363	1.551	0.021	0.373	0.042	0.290	0.081	2419	281	0.02704	0.062	-0.636	1.718	0.863
600PDT125-22[1]	0.0232	50	0.197	0.67	0.950	2.195	0.023	0.341	0.043	0.638	0.119	3568	186	0.03536	0.158	-0.522	2.282	0.948
162PDT200-22	0.0232	50	0.130	0.44	0.074	0.755	0.057	0.661	0.041	0.041	0.031	935	566	0.02340	0.030	-1.574	1.867	0.289
250PDT200-22	0.0232	50	0.151	0.51	0.182	1.100	0.066	0.660	0.042	0.112	0.050	1485	452	0.02704	0.076	-1.427	1.919	0.447
362PDT200-22	0.0232	50	0.177	0.60	0.408	1.519	0.074	0.647	0.043	0.268	0.073	2189	310	0.03173	0.177	-1.278	2.088	0.625
400PDT200-22	0.0232	50	0.186	0.63	0.506	1.652	0.076	0.641	0.043	0.326	0.081	2421	281	0.03328	0.221	-1.236	2.161	0.673
600PDT200-22[1]	0.0232	50	0.232	0.79	1.270	2.340	0.085	0.606	0.043	0.746	0.123	3675	186	0.04161	0.562	-1.055	2.637	0.840
162PDT250-22	0.0232	50	0.154	0.52	0.091	0.769	0.104	0.823	0.041	0.045	0.031	921	566	0.02756	0.055	-2.053	2.342	0.231
250PDT250-22	0.0232	50	0.174	0.59	0.221	1.126	0.120	0.829	0.042	0.122	0.049	1472	452	0.03120	0.141	-1.888	2.350	0.354
362PDT250-22	0.0232	50	0.200	0.68	0.487	1.560	0.135	0.822	0.043	0.277	0.073	2183	310	0.03590	0.324	-1.716	2.460	0.514
400PDT250-22	0.0232	50	0.209	0.71	0.602	1.698	0.139	0.817	0.043	0.338	0.081	2418	281	0.03744	0.404	-1.666	2.516	0.561
600PDT250-22[1]	0.0232	50	0.255	0.87	1.483	2.411	0.157	0.785	0.043	0.779	0.123	3687	186	0.04577	1.022	-1.448	2.920	0.754

To keep things simple, we've only listed the standard ProSTUD members used in your market.
Use SubmittalPro® or visit clarkdietrich.com for the non-standard ProSTUD members shown on page 3.

Notes:

- Calculated properties are based on AISI S100-07, North American Specification for Design of Cold-Formed Steel Structural Members.
- Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI A7.2.
- Tabulated gross properties, including torsional properties, are based on full-unreduced cross section of the studs, away from punchouts.
- Tabulated gross properties, including torsional properties, are based on full-unreduced cross section of the tracks.
- For deflection calculations, use the effective moment of inertia.
- Allowable moment includes cold work of forming.
- Allowable moment is taken as the lowest value based on local or distortional buckling. Distortional buckling strength is based on a k-phi = 0.
- Web depth for track sections is equal to the nominal height plus two times the design thickness plus the bend radius. Hems on non-structural track sections are ignored.

1 Web-height to thickness ratio exceeds 200. Web stiffeners are required at bearing points.
2 Web-height to thickness ratio exceeds 260. Web stiffeners are required at bearing and intermediate points.

Turn to ClarkDietrich for a complete lineup of steel construction products and services nationwide:

Interior Framing · Exterior Framing · Interior Finishing · Clips/Connectors · Metal Lath/Accessories · Engineering

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The technical content of this literature is effective 3/23/12 and supersedes all previous information.

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Product Submittal Sheet

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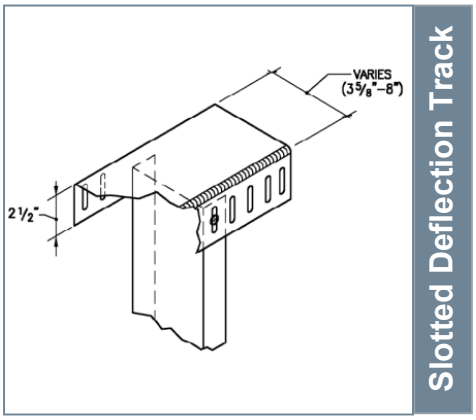
09.22.16 (Non-Structural Metal Framing)

Brady SLP-TRK® Sliptrack Non-Structural System

Drywall slotted deflection track for interior walls



- **Allows up to 1" vert. deflection**
- **UL Approved 1 & 2 hour systems**

Brady's SLP-TRK® provides a positive attachment for wall strength and allows for 1" vertical movement. Movement caused by normal head-of-wall and floor extension or compression is absorbed by SLP-TRK® to prevent damage to the wall system.

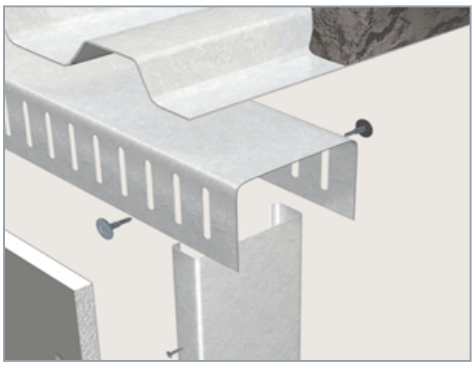
Waferhead screws positively attach the stud through SLP-TRK's vertical slots. Floor deck movement is absorbed by SLP-TRK® at the center of the construction joint.

Brady's SLP-TRK® smoothly integrates with a variety of wall installation systems and is extremely user-friendly, as well as economical. The simple design and easy installation reduces the cost of materials and labor. And the installer can use the head-of-wall systems he prefers to work with. Sliptrack Systems complies with the toughest code requirements in the country, if not the world. It has been tested with a variety of leading fire-stop products, and has outperformed the requirements of stringent fire and hose stream testing ASTM E-119, ASTM E-814. Sliptrack also has met and exceeded the latest seismic cycling standards found in UL2079 and ASTM1966

Product Data & Ordering Information:

Material: All Material: Grade 33ksi yield strength, G40
18mils: 25 Gauge, 0.0188" Design Thickness, 0.0179" Min. Thickness
33mils: 20 Gauge, 0.0346" Design Thickness, 0.0329" Min. Thickness
43mils: 18 Gauge, 0.0451" Design Thickness, 0.0428" Min. Thickness

Dimensions: 2-1/2" legs with an inside depth equal to the depth of the stud
Vertical slots are 1/4" wide x 1-1/2" long and spaced every 1"o.c.



ASTM & Code Standards:

- ASTM C645, A653 & A1003.
- ESR-1042
- MSDS & Product Certification Information is available at www.clarkdietrich.com

Other available Brady SLP-TRK Systems:

Available in 2-1/2",3-5/8", 4", 6" and 8" deep systems in 54mils(16ga) and 68mils(14ga),G60

Allowable Lateral Loads:

- 18mils (25gauge) SLP-TRK® P = 33 lbs.
- 33mils (20gauge) SLP-TRK® P = 138 lbs.
- 43mils (18gauge) SLP-TRK® P = 163 lbs.

Calculating slip track point load:
Point Load (P) = (wind pressure PSF) x (spacing FT) x (wall stud length FT) / 2
Example: (5 PSF) x (1.33 FT) x (9.5 FT) / 2 = 31.7 lbs.

For more installation and fire rated assemblies on either of these systems, refer to: www.clarkdietrich.com
SLP-TRK® is a registered trademark of SlipTrack Systems, Inc.

GREEN Benefits and Recycled Content:

LEED Credit MR 2 - ClarkDietrich products are manufactured from cold-formed steel. Steel is 100% recyclable, which helps divert debris from the waste stream. The contribution to LEED must be calculated by the contractor based on weight or volume.
LEED Credit MR 4 - ClarkDietrich's steel products have a minimum of 25.5% post-consumer recycled content, and 6.8% pre-consumer. If you wish to report a higher number for your project or seek Credit MR 5 please contact Technical Services at 888-437-3244 or visit www.clarkdietrich.com.

Project Information	Contractor Information	Architect Information
Name:	Name:	Name:
Address:	Contact:	Contact:
	Phone:	Phone:
	Fax:	Fax:

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Type: Complying with ASTM C1177/C 1177M, moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Basis of design Product: “DensArmor Plus” as manufactured by G-P Gypsum.

D. High-Impact Type: ASTM C 1396. Manufactured with Type X core, fiberglass mesh embedded to back side for greater resistance to through-penetration (impact resistance).

1. Core: 5/8 inch thick.
2. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
3. Products: Subject to compliance with requirements, provide one of the following:

a. National Gypsum Company; Gold Bond Hi-Impact® Brand XP® Gypsum Board.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; GlasRoc Sheathing.
b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond, e(2)XP.
d. USG Corporation; Securock Glass Mat Sheathing.

2. Core: 5/8 inch, Type X.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material:

a. Galvanized or aluminum-coated steel sheet or rolled zinc.
b. Trim-Tex, Super Seal Tear Away™ L Bead where abutting exterior metal doors and windows.

2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (control) joint.
d. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.

a. Use setting-type taping with mold-resistant gypsum wallboard.

3. Fill Coat: For second coat, use setting-type, sandable topping or drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: Not required.

D. Joint Compound for Exterior Applications:

1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; AC-20 FTR or AIS-919.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

G. Fire-Resistive Joint Systems: As specified in Division 07 Section “Fire-Resistive Joint Systems.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

K. Fire-Resistance-Rated Gypsum Board Assemblies: Provide fire-resistive joint system at the top of fire-resistance-rated gypsum board assemblies. Provide firestop system around any structural penetration of wall assembly.

L. Smoke-Rated Gypsum Board Assemblies: Provide a tight, taped joint at the top of smoke-rated assemblies and around any penetrations to assemblies at both side of the assembly. The use of acoustical sealant will be acceptable to fill gaps up to 3/8 inch wide.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: As indicated on Drawings.
2. Impact-Resistant Type: As indicated on Drawings.
3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer

joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings or according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Where indicated on Drawings.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
5. Level 5: Not required.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

3.7 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Complete the following in areas to receive gypsum board ceilings:

a. Installation, insulation, and leak and pressure testing of water piping systems.
b. Installation of air-duct systems.
c. Installation of air devices.
d. Installation of mechanical system control-air tubing.
e. Installation of ceiling support framing.
f. Installation of Penetration Firestopping and Fire-Resistive Joint Systems.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

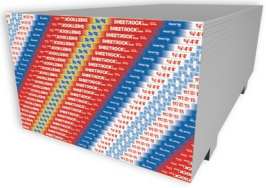
C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

Submittal Sheet
09250

Sheetrock® Gypsum Panels



Regular and Firecode® Cores

Quality interior wall and ceiling panels at low cost

- Fire-resistant dry construction
- Quick installation and decoration
- Score and snap easily
- Resist cracking and warping
- Specialized types for all systems

Description

SHEETROCK® brand gypsum panels are factory-fabricated, composed of a fire-resistant gypsum core encased in heavy natural-finish face paper and strong liner paper on the back side. The face paper is folded around the long edges to reinforce and protect the core, and the ends are square-cut and finished smooth. Long edges of panels are tapered, allowing joints to be reinforced and concealed with a USG joint treatment system.

SHEETROCK gypsum panels are available with three core types for standard construction uses.

Regular core

With a regular core, available in three thicknesses for specific purposes.

1/2″ Panels Recommended for single-layer application in residential construction.
3/8″ Panels Lightweight, applied principally in the double-wall system over wood framing, and in repair and remodeling.
1/4″ Panels Lightweight, low-cost, utility gypsum panels, used as base layer for improving sound control in double-layer steel and wood-stud partitions, and for use over old wall and ceiling surfaces. Also for forming curved surfaces with short radii.

FIRECODE® Core

5/8″ Type X Gypsum Panels Provide additional fire resistance over regular panels.

FIRECODE C Core

1/2″ and 5/8″ Type C Gypsum Panels Specially formulated mineral core provides fire resistance superior to that offered by FIRECODE Core gypsum panels.

Limitations

1. Avoid exposure to sustained temperatures exceeding 125 ˚F (52 ˚C).
2. Avoid exposure to excessive, repetitive or continuous moisture before, during and after installation. Eliminate sources of moisture immediately.
3. Non-loadbearing.
4. Fire-resistance ratings achieved when assembled in accordance with UL designs.

Finishing and Decorating

For high-quality finishing results, USG recommends the following products:

- SHEETROCK® ready-mixed joint compounds
- SHEETROCK® setting-type joint compounds
- SHEETROCK® joint tape
- SHEETROCK® First Coat primer
- SHEETROCK™ paper-faced metal bead and trim
- SHEETROCK® TUFF-HIDE™ primer-surfacer

Painting products and systems should be used which comply with recommendations and requirements in Appendixes of ASTM C840. For priming and decorating with paint, texture or wall covering, follow manufacturer's directions for materials used.

All surfaces, including applied joint compound, must be thoroughly dry, dust-free, and not glossy. Prime with SHEETROCK First Coat primer or with an undiluted, interior latex flat paint with high-solids content. Allow to dry before decorating.

To improve fastener concealment, where gypsum panel walls and ceilings will be subjected to severe artificial or natural side lighting and be decorated with a gloss paint (egg shell, semi-gloss or gloss), the gypsum panel

surface should be skim coated with joint compound. This equalizes suction and texture differences between the drywall face paper and the finished joint compound before painting. As an alternative to skim coating, or when a Level 5 finish is required, use SHEETROCK TUFF HIDE™ primer-surfacer.

Product Data

Size: 1/4″, 3/8″, 1/2″ and 5/8″ x 48″ wide; 8′–14′ long. 1/2″ and 5/8″ also available in 54″ wide.

Weight: 1/4″ – 1.2 lbs/sf; 3/8″ – 1.4 lbs/sf; 1/2″ – 1.6 lbs/sf; 5/8″ – 2.2 lbs/sf.

Thermal Resistance "R": For 1/2″ thickness: 0.45 °F x ft.^{2} x h/Btu (0.08 K x m^2/W).

Thermal Coefficient of Expansion: Unrestrained: 40-100 °F (4-38 °C):
9.0 x 10^{-6} in./in./°F (16.2 x 10^{-6} mm/mm/°C) (16.2 µm/m/°C).

Hygrometric Coefficient of Expansion: Unrestrained: 5-90% r.h.
7.2 x 10^{-6} in./in./% r.h. (7.2 x 10^{-6} mm/mm/% r.h.) (7.2 µm/m/% r.h.).

Packaging: 2 panels per bundle.

Test Data

Surface Burning Characteristics: Flame spread 15, smoke developed 0.

Maximum Frame Spacing Drywall Construction

Direct Application	Panel thickness(1)		Location	Application method(2)	Max. frame spacing o.c.	
	in.	mm			in.	mm
Single-Layer	3/8	9.5	ceilings(3)	perpendicular(4)	16	406
				parallel(4)	16	406
	1/2	12.7	ceilings	perpendicular	24(5)(6)	610
				parallel(4)	16	406
			sidewalls	parallel or perpendicular	24	610
				parallel(4)	16	406
	5/8	15.9	ceilings(6)	perpendicular	24	610
			sidewalls	parallel or perpendicular	24	610
Double-Layer	3/8	9.5	ceilings(7)	perpendicular	16	406
			sidewalls	perpendicular or parallel	24(8)	610
	1/2 and 5/8	12.7 and 15.9	ceilings	perpendicular or parallel	24(8)	610
			sidewalls	perpendicular	24(8)	610

(1) 5/8″ thickness is recommended for the finest single-layer construction, providing increased resistance to fire and transmission of sound; 1/2″ for single-layer application in new residential construction and remodeling; and 3/8″ for repair and remodeling over existing surfaces. (2) Long edge position relative to framing. (3) Not recommended below unheated spaces. (4) Not recommended if water-based texturing material is to be applied. (5) Max. spacing 16″ if water-based texturing material is to be applied. (6) If 1/2″ SHEETROCK® interior ceiling board is used in place of gypsum panels, max. spacing is 24″ o.c. for perpendicular application with weight of unsupported insulation not exceeding 1.3 psf., 16″ o.c. with weight of unsupported insulation not exceeding 2.2 psf. (7) Adhesive must be used to laminate 3/8″ board for double-layer ceilings. (8) Max spacing 16″ o.c. if fire rating required.

Compliance

Meets ASTM C1396.

Submittal Approvals:

Job Name	
Contractor	**Date**

Trademarks
The following trademarks used herein are owned by United States Gypsum Company or a related company: DURABOND, EASY SAND, FIRECODE, SHEETROCK, TUFF HIDE.

Note
Products described here may not be available in all geographic markets. Consult your U.S. Gypsum Company sales office or representative for information.

Notice
We shall not be liable for incidental and consequential damages, directly or indirectly sustained, nor for any loss caused by application of these goods not in accordance with current printed instructions or for other than the intended use. Our liability is expressly limited to replacement of defective goods. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from date it was or reasonably should have been discovered.

Safety First!
Follow good safety and industrial hygiene practices during handling and installation of all products and systems. Take necessary precautions and wear the appropriate personal protective equipment as needed. Read material safety data sheets and related literature on products before specification and/or installation.

Manufactured by
United States Gypsum Company
550 West Adams Street
Chicago, IL 60661

800 USG.4YOU (874-4968)
usg.com

WB1473/rev. 1-07

Georgia-Pacific

DensArmor Plus®

High-Performance Interior Panel

Technical Service Hotline 1.800.225.6119 or
www.gpgypsum.com

Manufacturer

Georgia-Pacific Gypsum LLC
133 Peachtree Street
Atlanta, GA 30303

Georgia-Pacific Canada LP
2180 Meadowvale Boulevard, Suite 200
Mississauga, ON L5N 5S3

Technical Service Hotline: 1-800-225-6119

Description

DensArmor Plus® High-Performance Interior Panels are noncombustible (per ASTM E 136) interior panels that consists of a moisture-resistant gypsum core with coated fiberglass mats. The fiberglass mats provide superior protection from incidental moisture. DensArmor Plus panels are highly resistant to the growth of mold, and have scored a 10, the highest level of performance for mold resistance under ASTM D 3273 test method.

The core of DensArmor Plus panels is reinforced with fiberglass, increasing the product's strength. The treated core and the coated facings made with fiberglass offer greater moisture resistance and improved dimensional stability than regular gypsum board. The product resists warping, rippling and buckling.

They have a tapered edge to receive joint treatment. The field of the board can be finished in the same manner as regular gypsum board.

DensArmor Plus Interior Panels are the first drywall panels to be GREENGUARD Indoor Air Quality Certified® and GREENGUARD Children & Schools℠ Certified for low emissions of volatile organic compounds (VOCs) by a leading third-party organization, GREENGUARD Environmental Institute. In addition, DensArmor Plus Interior Panels are the first drywall panels listed as GREENGUARD microbial resistant. This listing means DensArmor Plus panels, which feature fiberglass mats instead of paper facings used on the surface of traditional gypsum board products, resist mold growth. The microbial resistant test is based on ASTM Standard D 6329-98, a testing standard set by ASTM International, which develops testing guidelines and procedures for building materials, products, systems, and services.

DensArmor Plus panels also are listed in the Collaborative for High Performance Schools® (CHPS™) High Performance Products Database for low emissions of VOCs. CHPS is a national non-profit organization that works with school districts and their design teams to improve the quality of education by using products that have met requirements to receive CHPS credits.

Primary Uses

DensArmor Plus Interior Panels are an interior wall or ceiling covering material for use in new construction or renovation work. They are designed for direct attachment with screws or nails to wood and metal framing or existing surfaces. They may be used as a covering material for flat or curved structures. DensArmor Plus panels are manufactured with fiberglass mat surfaces. They have a tapered edge to receive joint treatment.

- Use on interiors of exterior walls, where moisture intrusion is most likely.
- Use in pre-rock areas, where the windows, doors or roof have not been installed making moisture intrusion inevitable. DensArmor Plus panels come with a limited warranty against delamination and deterioration for up to 12 months of exposure to normal weather conditions.*
- Where required by code, Georgia-Pacific Gypsum recommends the use of DensShield® Tile Backer in wet areas behind tile, such as tub and shower areas.

*For complete warranty details, visit www.gpgypsum.com.

Limitations

DensArmor Plus Interior Panels are a non-structural product and should not be used as a nailing base to support heavy wall-mounted objects.

Intended for interior applications and soffits in protected areas, DensArmor Plus panels must be kept dry during storage and handling.

Do not use DensArmor Plus® Fireguard® (per ASTM C 1658) panels where there is prolonged exposure to temperatures exceeding 125˚F (52˚C), e.g. adjacent to wood burning stoves, heating appliances, saunas or steam rooms.

Technical Data

Flame spread and smoke developed rating of 0/0 when tested in accordance with ASTM E 84 or CAN/ULC S-102.

Noncombustible as described and tested in accordance with ASTM E 136.

5/8″ DensArmor Plus® is UL and ULC Classified **Type DAP**. 1/2″ and 5/8″ DensArmor Plus® Fireguard C™ products are UL and ULC Classified **Type DAPC**.

Decoration

DensArmor Plus Interior Panels are designed to accept most types of paints, textures and wall covering materials. Because of the enhanced moisture- and mold-resistant properties of DensArmor Plus panels, drying times for both joint compound and wall coverings may vary. Always follow paint or wall covering manufacturer's installation instructions when applying either of these finishes. Georgia-Pacific Gypsum strongly recommends priming the surface of DensArmor Plus panels with a quality, high solids primer/sealer before applying a final decorative material. Priming will equalize the suction variations between the joint compounds and the fiberglass surfaces. If glossy paints are used in such areas as kitchens or bathrooms, skim coat joint compound over the entire surface of DensArmor Plus panels to reduce highlighting or joint photographing. This method is also recommended in areas with severe natural or artificial side lighting.

Handling Precautions

See *Handling and Use–Caution* section at end of this document.

Stack DensArmor Plus High-Performance Interior Panel flat on a level surface. As individual sheets are removed for installation, they should be raised up on edge carefully and carried in a vertical position. Appropriate handling for gypsum board is also outlined in Gypsum Association Publications GA-216 and GA 801.

Take care to avoid impact, undue flexing and subsequent damage to board edges, ends and corners.

Note: Material Safety Data Sheet (MSDS) is available at www.gpgypsum.com or call 1-404-652-5119.

Applicable Standards

Manufactured to meet ASTM C 1658, ASTM C 1396 Section 7 and ASTM C 1177.

Sizes and Edges

DensArmor Plus Thickness: 1/2″ (12.7 mm); Width: 4′ (1219 mm); Lengths: 8′-12′ (2438 mm-3658 mm); Edges: Tapered

DensArmor Plus Fireguard C Thickness: 1/2″ (12.7 mm); Width: 4′ (1219 mm); Lengths: 8′-12′ (2438 mm-3658 mm); Edges: Tapered

DensArmor Plus Fireguard Thickness: 5/8″ (15.9 mm); Width: 4′ (1219 mm); Lengths: 8′-12′ (2438 mm-3658 mm); Edges: Tapered

DensArmor Plus Fireguard C Thickness: 5/8″ (15.9 mm); Width: 4′ (1219 mm); Lengths: 8′-12′ (2438 mm-3658 mm); Edges: Tapered

continued →

Submittal Approvals

Job Name _____

Contractor _____

Date _____

Stamps/Signatures

Georgia-Pacific

DensArmor Plus®

High-Performance Interior Panel

Technical Service Hotline 1.800.225.6119 or
www.gpgypsum.com

Installation

DensArmor Plus High-Performance Interior Panels should be installed according to the most current versions of Gypsum Association Publication GA-216 "Application and Finishing of Gypsum Board for Non-Fire-Rated Construction."

For fire-rated installations, the installation and details shall be in conformity with those assemblies published in the Gypsum Association Fire Resistance Design Manual GA-600, UL and ULC Fire Resistance Directories.

Physical Properties

Properties	DensArmor Plus®	DensArmor Plus® Fireguard C™	DensArmor Plus® Fireguard®	DensArmor Plus® Fireguard C™
Thickness, nominal[4]	1/2″ (12.7 mm) ± 1/64″ (0.4 mm)	1/2″ (12.7 mm) ± 1/64″ (0.4 mm)	5/8″ (15.9 mm) ± 1/64″ (0.4 mm)	5/8″ (15.9 mm) ± 1/64″ (0.4 mm)
Width, standard[4]	4′ (1219 mm) ± 3/32″ (2.4 mm)	4′ (1219 mm) ± 3/32″ (2.4 mm)	4′ (1219 mm) ± 3/32″ (2.4 mm)	4′ (1219 mm) ± 3/32″ (2.4 mm)
Length, standard[4]	8′ (2438 mm) to 12′ (3658 mm) ± 1/4″ (6.4 mm)	8′ (2438 mm) to 12′ (3658 mm) ± 1/4″ (6.4 mm)	8′ (2438 mm) to 12′ (3658 mm) ± 1/4″ (6.4 mm)	8′ (2438 mm) to 12′ (3658 mm) ± 1/4″ (6.4 mm)
Weight[1], nominal, lbs./sq. ft., (Kg/m^2)	2.02[1] (9.9)	2.0[1] (9.8)	2.5[1] (12.2)	2.4[1] (12.1)
Permeance[7], Perms (ng/Pa•s•m^2)	>10 (570)	>10 (570)	>10 (570)	>10 (570)
Linear expansion with moisture change, in/in %RH (mm/mm %RH)	6.25 x 10^{-6}	6.25 x 10^{-6}	6.25 x 10^{-6}	6.25 x 10^{-6}
Coefficient of thermal expansion, in/in/°F (mm/mm/°C)	8.5 x 10^{-6} (15.3 x 10^{-6})	8.5 x 10^{-6} (15.3 x 10^{-6})	8.5 x 10^{-6} (15.3 x 10^{-6})	8.5 x 10^{-6} (15.3 x 10^{-6})
Flexural strength, parallel, lbf.[3, 4] (N)	>80 (356)	>80 (356)	>100 (444)	>100 (444)
Flexural strength, perpendicular, lbf.[3, 4] (N)	>100 (444)	>100 (444)	>140 (622)	>140 (622)
R Value[2], ft^2•°F•hr/BTU (m^2•K/W)	.56 (0.099)	.56 (0.099)	.67 (0.118)	.67 (0.118)
Combustibility[6]	Noncombustible	Noncombustible	Noncombustible	Noncombustible
Nail pull resistance, lbf.[3, 4] (N)	80 (356)	80 (356)	90 (400)	90 (400)
Hardness core, edges and ends, lbf. (N)	≥15 (67)	≥15 (67)	≥15 (67)	≥15 (67)
Water absorption (% of weight)[3, 4]	<5	<5	<5	<5
Surface water absorption[3, 4]	<1.6 grams	<1.6 grams	<1.6 grams	<1.6 grams
Surface burning characteristics (per ASTM E 84 or CAN/ULC-S102): flame spread/smoke developed	0/0	0/0	0/0	0/0
Humidified deflection[3, 4]	2/8″ (6.4 mm)	2/8″ (6.4 mm)	1/8″ (3 mm)	1/8″ (3 mm)
Bending radius[5]	6′ (1829 mm)	6′ (1829 mm)	8′ (2438 mm)	8′ (2438 mm)

[1] Represents approximate weight for design and shipping purposes
[2] Tested in accordance with ASTM C 518
[3] Tested in accordance with ASTM C 473
[4] Specified values per ASTM C 1658 and ASTM 1177
[5] Double fasteners on ends as needed
[6] As defined and tested in accordance with CAN/ULC-S114 in combination with ASTM E 136
[7] Tested in accordance with ASTM E 96 (dry cup method)

Georgia-Pacific Gypsum

U.S.A.– Georgia-Pacific Gypsum LLC
Canada – Georgia-Pacific Canada LP

SALES INFORMATION AND ORDER PLACEMENT

U.S.A. Midwest: **1-800-876-4746** West: **1-800-824-7503**
South: **1-800-327-2344** Northeast: **1-800-947-4497**

CANADA Canada Toll Free: **1-800-387-6823**
Quebec Toll Free: **1-800-361-0486**

TECHNICAL INFORMATION

U.S.A. and Canada: **1-800-225-6119**
www.gpgypsum.com

TRADEMARKS Unless otherwise noted, all trademarks are owned by or licensed to Georgia-Pacific Gypsum LLC. GREENGUARD, and GREENGUARD Children & Schools are registered certification marks used under license through the GREENGUARD Environmental Institute. CHPS is a trademark owned by Collaborative for High Performance Schools, Inc.

WARRANTIES, REMEDIES AND TERMS OF SALE For current warranty information for this product, please go to www.gpgypsum.com and select the product for warranty information. All sales of this product by Georgia-Pacific are subject to our Terms of Sale available at www.gpgypsum.com.

UPDATES AND CURRENT INFORMATION The information in this document may change without notice. Visit our website at www.gpgypsum.com for updates and current information.

CAUTION For product fire, safety and use information, go to www.gp.com/safetyinfo or call 1-800-225-6119.

HANDLING AND USE–CAUTION This product contains fiberglass facings which may cause skin irritation. Dust and fibers produced during the handling and installation of the product may cause skin, eye and respiratory tract irritation. Avoid breathing dust and minimize contact with skin and eyes. Wear long sleeve shirts, long pants and eye protection. Always maintain adequate ventilation. Use a dust mask or NIOSH/MSHA approved respirator as appropriate in dusty or poorly ventilated areas.

FIRE SAFETY CAUTION Passing a fire test in a controlled laboratory setting and/or certifying or labeling a product as having a one-hour, two-hour, or any other fire resistance or protection rating and, therefore, as acceptable for use in certain fire rated assemblies/systems, does not mean that either a particular assembly/system incorporating the product, or any given piece of the product itself, will necessarily provide one-hour fire resistance, two-hour fire resistance, or any other specified fire resistance or protection in an actual fire. In the event of an actual fire, you should immediately take any and all actions necessary for your safety and the safety of others without regard for any fire rating of any product or assembly/system.

GOLD BOND® BRAND HI-IMPACT® XP® GYPSUM BOARD

MANUFACTURER

National Gypsum Company
2001 Rexford Road
Charlotte, NC 28211
(704) 365-7300

Technical Information:
1-800-NATIONAL
(1-800-628-4662)

Fax: 1-800-FAX NGC1
(1-800-329-6421)

Internet Home Page:
nationalgypsum.com
nationalgypsum.com/espanol

09 29 00/NGC BuyLine: 1100

DESCRIPTION

Gold Bond® BRAND Hi-Impact® XP® Gypsum Board with Sporgard™* consists of a tapered edge, moisture-resistant, fire-resistant Type X gypsum core encased in a heavy, abrasion and mold/mildew/moisture resistant, 100% recycled, National Gypsum's original PURPLE™ paper on the face side and a heavy, abrasion and mold/mildew/moisture resistant, 100% recycled gray paper on the back side. A fiberglass mesh is embedded into the core, close to the back of the board to provide additional impact/penetration resistance.

Hi-Impact XP Gypsum Board features a specially formulated core to provide fire resistance ratings when used in tested systems in addition to providing extra protection against mold and mildew compared to standard gypsum board products. Tapered edges allow joints to be reinforced with ProForm® BRAND Joint Tape and concealed with ProForm® BRAND Ready Mix or Quick Set Setting Compounds. For optimum mold performance, ProForm® BRAND XP® Ready Mix is recommended for use.

BASIC USES

This unique gypsum board is designed for interior use in wall assemblies in areas where surface durability, impact/penetration, moisture, mold and mildew resistance are major concerns.

5/8" Fire-Shield Hi-Impact XP panels may be used where Type X gypsum panels are specified in some fire-rated wall assemblies (e.g., UL U300, U400 and V400 series).

ADVANTAGES

- Resists the growth of mold per ASTM G 21 with a score of 0, the best possible score.
- Resists the growth of mold per ASTM D 3273 with a score of 10, the best possible score.
- Less than 5% water absorption per ASTM C 473.
- Hi-Impact XP Gypsum Board features a Type X core to provide additional fire resistance when used in tested systems.
- Hi-Impact XP Gypsum Board is easily cut for quick installation, permitting painting or other decoration and the installation of most metal or wood trim almost immediately.
- The gypsum core will not support combustion or transmit temperatures greatly in excess of 212°F (100°C) until completely calcined, a slow process.
- Expansion and contraction under normal atmospheric changes are negligible.
- Does not require the added strength of a setting type compound for joint reinforcement.
- Allows for same joint treatment reinforcement procedures as standard drywall, thereby reducing cost and the risk of improper installation.
- Transitions into drywall without the use of control joints.
- Hi-Impact XP Gypsum Board can be used as a tile backer board in dry areas or areas with limited water exposure such as toilet/sink areas and areas above tile in tubs and showers.
- Saves time by eliminating the need for special cutting tools and rasping of cut edges.

GREENGUARD CERTIFIED

Hi-Impact XP Gypsum Board is GREENGUARD Children & Schools℠ Certified for indoor air quality.

MOLD AND MILDEW RESISTANCE

Hi-Impact XP Gypsum Board was designed to provide extra protection against mold and mildew compared to standard gypsum board products. When tested by an independent laboratory, Hi-Impact XP Gypsum Board products received the highest possible ratings on ASTM G 21 and ASTM D 3273.

No material can be considered "mold-proof," nor is it certain that any material will resist mold or mildew indefinitely. When used in conjunction with good design, handling and construction practices, Hi-Impact XP Gypsum Board products can provide increased mold resistance versus standard gypsum board products. As with any building material, avoiding water exposure during handling, storage and installation and after installation is complete, is the best way to avoid the formation of mold or mildew.

LIMITATIONS

- For interior use only.
- Exposure to excessive or continuous moisture and extreme temperatures should be avoided per ASTM C 840.
- Hi-Impact XP Gypsum Board is not recommended where it will be exposed to temperatures exceeding 125°F (52°C) for extended periods of time.

(Continued next page)

Job Name _____

Contractor _____ Date _____

Submittal Approvals: (Stamps or Signatures)

**Sporgard is a trademark of a Syngenta Group Company*

- Hi-Impact XP Gypsum Board should not be used as a backer board directly behind tile in tub and shower areas.
- Hi-Impact XP Gypsum Board should not be used in areas subject to constant and/or excessive moisture and high humidity such as gang showers, saunas, steam rooms and swimming pool enclosures. PermaBase® BRAND Cement Board is recommended for these areas.
- Hi-Impact XP Gypsum Board must be stored off the ground and under cover. Sufficient risers must be used to assure support for the entire length of the gypsum board to prevent sagging.
- Hi-Impact XP Gypsum Board must be kept dry to minimize the potential for mold growth. Adequate care should be taken while transporting, storing, applying and maintaining gypsum board. For additional information, refer to the Gypsum Association publication, *"Guidelines for the Prevention of Mold Growth on Gypsum Wallboard"* (GA-238-03), which is available at www.gypsum.org under the "Download Free Gypsum Association Publications" section.
- Minimum 20 gauge framing.

COMPOSITION & MATERIALS

Hi-Impact XP Gypsum Board is a manufactured panel with a high density gypsum core encased in tough, robust paper with fiberglass mesh embedded in the core close to the backside of the panel. Various aggregates are added to the core to enhance fire and moisture resistive qualities. Hi-Impact XP Gypsum Board contains no asbestos.

ACCESSORIES

- Fasteners: drywall screws
- ProForm Joint Tape
- ProForm Ready Mix or ProForm Quick Set/Quick Set Lite Setting Compound
- Cornerbead, trims, casing beads
- Furring channels
- E-Z Strip control joints or .093 zinc control joints

TECHNICAL DATA

PHYSICAL PROPERTIES	
Thickness, nominal	5/8" Type X (15.9 mm)
Width, nominal	4' (1219 mm)
Length, standard	8' through 12' (2438 mm - 3657 mm)
Weight, lbs./sq.ft., nominal	2.8
Edges	Tapered
Surface Burning Characteristics (per ASTM E 84)	Flame spread: 15 Smoke developed: 0
Surface Abrasion Resistance (per ASTM C 1629)	Level 3
Indentation Resistance (per ASTM C 1629)	Level 1
Soft Body Impact Resistance (per ASTM C 1629)	Level 3
Hard Body Impact Resistance (per ASTM C 1629)	Level 3

APPLICABLE STANDARDS AND REFERENCES
ASTM C 1396
ASTM C 1629
ASTM C 840
ASTM D 3273
ASTM G 21
Gypsum Association GA-216
Gypsum Association GA-214
Gypsum Association GA-801
National Gypsum Company, *Gypsum Construction Guide*

FIRE RESISTANCE RATINGS

Fire resistance ratings represent the results of tests on assemblies made up of specific materials in a specific configuration. When selecting construction designs to meet certain fire resistance requirements, caution must be used to ensure that each component of the assembly is the one specified in the test. Further, precautions should be taken that assembly procedures are in accordance with those of the tested assembly. (For copies of specific tests, call 1-800-NATIONAL.)

UL CORE DESIGNATION

5/8" Hi-Impact XP: FSW-5

INSTALLATION

RECOMMENDATIONS

Installation of 5/8" Hi-Impact XP Fire-Shield Type X Gypsum Board should be consistent with methods described in Applicable Standards with one exception—for best results, cutting and scoring of Hi-Impact XP Gypsum Board should be from the back side of the board.

Listed impact/penetration ratings apply to walls constructed with Hi-Impact XP Gypsum Board applied with long edges parallel to and centered over minimum 20 gauge framing members spaced a maximum of 16" o.c.

GRIDMARX®

Hi-Impact XP Gypsum Board comes standard with GridMarX guide marks printed on the paper surface. These guide marks align with standard building dimensions and help to quickly identify fastener lines for stud and joist framing. Using GridMarX, accurate cuts can be made without having to draw lines. The use of GridMarX also provides quick identification and uniform nail/screw patterns.

GridMarX guide marks run the machine direction of the board at five points in 4" increments. Marks run along the edge in both tapers and at 16", 24" and 32" in the field of the board. The marks cover easily with no bleed-through using standard paint products.

Vertical Application - In a vertical application, GridMarX serve as a guide mark to help identify the exact location of framing members behind the gypsum board, eliminating the need for field-applied vertical lines.

Horizontal Application - In a horizontal application, GridMarX serve as a reference mark to help identify the location of framing members behind the gypsum board. (If framing member is located 2" to the right of the GridMarX at the top edge of the board, it will be located 2" to the right down the face of the board.)

DECORATION

For best painting results, all surfaces, including joint compound, should be clean, dust-free and not glossy. To improve fastener and joint concealment, a coat of high quality drywall primer is recommended to equalize the absorption between surface paper and joint compound.

The selection of a paint to give the specified or desired finished characteristics is the responsibility of the architect or contractor.

Hi-Impact XP Gypsum Board that is to have a wall covering applied to it should be prepared and primed as described for painting.

Gypsum Association GA-214, *Recommended Specification for Levels of Gypsum Board Finish*, should be referred to in order to determine the level of finishing needed to assure a surface properly prepared to accept the desired decoration.

National Gypsum®

Submittal Sheet
09250

Securock® Glass-Mat Sheathing

Regular and Firecode® Cores

Quality, high-performance sheathing designed for use in most exterior systems

- Treated gypsum core combined with fiberglass face and back offers exceptional water resistance
- Scores and snaps easily for quick installation
- For use in most exterior systems when properly detailed by exterior finish manufacturer
- Meets or exceeds the requirements of ASTM C1177

Description

USG SECUROCK® glass-mat sheathing is a noncombustible, moisture- and mold-resistant panel designed for use under exterior claddings where conventional gypsum sheathing products have traditionally been used, such as brick veneer, properly detailed Exterior Insulation Finish Systems (EIFS), clapboard siding, panel siding, shingle siding, shake siding and conventional stucco.

Advantages

Mold-Resistant High resistance to mold and mildew.
Resists Water Glass-mat sheathing facer on both sides sheds water.
Quick, Dry Installation Quick score and snap, no sawing or special tools, and rapid screw or nail attachment.
Exposure Can be exposed to weather for up to 12 months after application.
Warranted Performance SECUROCK glass-mat sheathing is guaranteed for five years against manufacturing defects and for 12 months of weather exposure.

Limitations

1. SECUROCK glass-mat sheathing shall not be used as a nail base for exterior cladding.
2. Specific requirements regarding framing spacing, fastener spacing and fastener specifics to provide required lateral wind-load resistance are the responsibility of the design professional. (Refer to technical data and specifications on the following pages.)
3. SECUROCK glass-mat sheathing offers resistance to weather, but is not intended for constant exposure to water. Protect this and all similar materials from the eroding effects of cascading water.
4. Not recommended for lamination to masonry surfaces. Use furring strips or framing.
5. Maximum stud spacing is 24" o.c.
6. SECUROCK glass-mat sheathing is not a finished surface.
7. SECUROCK glass-mat sheathing is not intended for tile applications.

Product Data

Dimensions 1/2" or 5/8" thick, 48" wide, 8', 9' and 10' long. Up to 12' lengths available in 5/8" thickness in some markets. Other sizes available on special order. Consult your United States Gypsum Company sales office or representative for more information.
Weight Approximately 2.0 psf for 1/2" thickness, 2.7 psf for 5/8" thickness.
Edge Configuration Square edges.
Compliance with Standards Meets or exceeds the physical property requirements of ASTM C1177. 5/8" SECUROCK glass-mat sheathing is UL classified as to fire resistance, surface-burning characteristics and core combustibility. ICC ES Evaluation Report ESR 3044.
Fire Performance SECUROCK glass-mat sheathing has a noncombustible core when tested in accordance with ASTM E136. Surface-burning characteristics—Flame spread 0, smoke developed 0, when tested in accordance with ASTM E84. Fire resistance—5/8" panels meet the requirements of Type X as defined in ASTM C1396 and ASTM C1177 when tested in accordance with ASTM E119. UL classified as to fire resistance. See Underwriters Laboratories Fire Resistance Directory for specific designs.
Tensile Bond Exceeds 15 psi requirements for both cementitious and acrylic adhesives per ASTM C297.

		1/2" SECUROCK Glass-Mat Sheathing	5/8" SECUROCK Glass-Mat Sheathing
Perm Ratings		25	26
Thermal Resistance Per ASTM C518 ("R") (in./ft.² °F)/Btu)		0.4	0.5
Bending Radius*	Dry	9 ft.	9 ft.

*Recommended fastener spacing is 6" o.c. when panels are bent.

Technical Data

Physical Properties Per ASTM C1177	1/2" SECUROCK Glass-Mat Sheathing	5/8" SECUROCK Glass-Mat Sheathing
Flexural Strength		
– Bearing edge perpendicular to board length—lbf	107	147
– Bearing edge parallel to board length—lbf	80	100
Water Absorption—% by wt. 2 hrs	10	10
Nail-Pull Resistance—lbf	80	90
Weight—psf	2.0	2.7
Surface-Burning Characteristics—flame/smoke	0/0	0/0
Coefficient of Thermal Expansion in./in./°F	8.5×10^{-6}	8.5×10^{-6}

Allowable Uniform Wind Load (psf) for 1/2"-Thick Panels

Frame Spacing	12"			16"			24"		
Fastener Spacing	**4**	**6**	**8**	**4**	**6**	**8**	**4**	**6**	**8**
Allowable Pressure	75	46	34	51	34	26	26	19	16

Allowable Uniform Wind Load (psf) for 5/8"-Thick Panels

Frame Spacing	12"			16"			24"		
Fastener Spacing	**4**	**6**	**8**	**4**	**6**	**8**	**4**	**6**	**8**
Allowable Pressure	107	67	50	75	50	38	34	27	24

Notes: Applicable for both steel and wood framing. The values in this table are based on testing per ASTM E330 and represent the capacity of the sheathing to resist flexural failure or fastener pull-through with a 3.0 factor of safety. Capacities are based on a minimum fastener head diameter of 0.325" (#6 bugle head screw). The withdrawal resistance of fasteners from framing is different on several factors, including but not limited to fastener type, fastener length and framing properties. The specification of fasteners is the responsibility of the designer of record. Manufacturer's recommendations are given below. These capacities assume continuous support of each stud flange over the full length of the sheathing panel. Allowable Pressures are based on a maximum deflection limitation of L/360. Consult USG representative for higher deflection limitations. Allowable pressure values are for short-term wind loads. Framing design is independent of these values. The design capacities of assemblies constructed with pneumatically driven fasteners are beyond the scope of this submittal sheet.

Application to Wood Stud Walls for Racking Resistance

For resisting wind and seismic loads: 1/2"-thick (12.7 mm) SECUROCK glass-mat sheathing will provide an allowable racking resistance of 122 plf (1.8 kN/m) when sheathing is attached to wood framing spaced 16" (406 mm) o.c. max. Application shall be by the use of nails: 11 gauge, 7/16" (11 mm) diameter head, 1-1/2" (38 mm) long, hot-dipped galvanized roofing nails, or #6 – 1-1/4" (32 mm) long corrosion-resistant bugle head screws. 5/8"-thick (15.9 mm) SECUROCK glass-mat sheathing will provide an allowable racking resistance of 138 plf (2.0 kN/m) when sheathing is attached to wood framing spaced 24" (610 mm) o.c. max. Application shall be by the use of nails: 11 gauge, 7/16" (11 mm) diameter head, 1-3/4" (44 mm) long, hot-dipped galvanized roofing nails, or #6 – 1-5/8" (41 mm) long corrosion-resistant bugle head screws. The SECUROCK glass-mat sheathing panels shall be applied solidly to the wall framing with the long edges of the panels parallel to the framing with all edges backed by framing members. Design capacities are based on a maximum fastener spacing of 4" (101 mm) o.c. around the perimeter of the sheathing panels and 8" (203 mm) o.c. along the intermediate framing members. The maximum height-length ratio shall not exceed 1.5:1 to be considered a shear wall segment. Studs and plates shall be anchored to resist forces. Shear walls using SECUROCK glass-mat sheathing shall not be used to resist forces imposed by masonry or concrete walls. The design capacities of assemblies constructed with pneumatically driven fasteners are beyond the scope of this submittal sheet.

Note: Local code requirements may limit the racking resistance values to a prescribed load; be sure to check with the authority having jurisdiction for the correct limitations when designing the racking resistance.

Installation

SECUROCK glass-mat sheathing may be used under exterior claddings where conventional gypsum sheathing products have traditionally been used, such as brick veneer, properly detailed Exterior Insulation Finish Systems (EIFS), clapboard siding, panel siding, shingle siding, shake siding and conventional stucco. If extreme weather conditions are possible, the design professional should consider recommending that panel joints be treated or a weather-resistant barrier be installed.

Specifications

Part 1: General	**1.1 Scope**		Specify to meet project requirements.
	1.2 Delivery and Storage of Materials		All materials shall be stored in an enclosed shelter providing protection from damage and exposure to the elements. Damaged or deteriorated materials shall be removed from the premises. Prior to installation, panels should be stacked flat (unless the contractor in charge of site safety directs otherwise to avoid point overloading of the structure or a tripping hazard) and reasonably protected from the elements. **Warning:** Store all SECUROCK glass-mat panels flat. Panels are heavy and can fall over, causing serious injury or death. Do not move unless authorized. Panels 12' in length will ship in banded units. To ensure safety and performance of the product, use of a forklift truck with minimum 35" span between the forks when moving the banded units is recommended. Keep the nylon bands on each lift until individual boards are moved.
Part 2: Products		**A.**	SECUROCK glass-mat sheathing—(1/2") (5/8") thick x 48" wide x 8'-10' long (up to 12' for 5/8" thickness) with square edges.
		B.	Nails—(1-1/2") (1-3/4"), 11-gauge hot-dipped galvanized roofing nails, 7/16" diameter head (minimum).
		C.	Screws—(1-1/4") (1-5/8") #6 bugle head corrosion-resistant fasteners. Where sheet-type weather-resistive barriers or self-adhering membranes are placed over the sheathing, corrosion resistance shall be equal to or greater than a hot-dipped galvanized coating of 1.5 ounces of zinc per square foot of surface area. Where liquid or fluid-applied air and water barriers are used, or where no sheet-type weather-resistive barrier is used over the sheathing, screws shall have a corrosion resistance of more than 800 hours per ASTM B117. Stainless steel fasteners shall be used in coastal or aggressive environments. Consult the building code for other requirements.
Part 3: Execution	**3.1 Walls—Sheathing**	**A.**	Apply weather-resistive or water barriers and flashing as required by and in accordance with the applicable local code requirements and the recommendations of the exterior cladding manufacturer, whichever is more stringent.
		B.	Maximum fastener spacing for vertical surfaces (walls) is 8" o.c.
		C.	Maximum frame spacing is 24" o.c.
		D.	Sheathing must be thoroughly dry prior to installing adhesively applied and self-adhered ice/water barriers and joint tape. Failure to do so will result in an insufficient bond to the sheathing.
		E.	Apply side labeled "USG SECUROCK" toward exterior. Fit ends and edges closely, but not forced together.
		F.	Fasteners shall be driven flush with the panel surface, without countersinking or deep enough to break the glass-mat, and into the framing.
		G.	Unless otherwise specified or required, SECUROCK glass-mat sheathing may be applied either perpendicular or parallel to wood or steel framing.
	3.2 Soffits—Sheathing Application		The maximum frame spacing for soffits is 16" o.c. when installed parallel to the joists and 24" o.c. when installed perpendicular to the joists. Maximum fastener spacing for horizontal surface (soffits) is 8" o.c.
	3.3 Control Joints		Control joints shall be installed at building expansion joints. Location and design of these control joints shall be detailed by the design professional. As a general rule, a 30-foot-maximum space between surface control joints is recommended.
	3.4 Shear- or Fire-Rated Construction		Shear- or fire-rated construction may have additional execution requirements as specified in local codes or the UL Fire Resistance Directory.

3.5 Weather-Resistant Barriers	No weather-resistant barrier is required for exposure warranty, but may be required by local codes or cladding system specifications.
3.6 Exterior Cladding Application	Consult exterior cladding manufacturer for installation instructions.
3.7 EIFS	EIFS, like all other cladding systems, is vulnerable to moisture that enters the cavity through wall penetrations, such as windows, doors, deck attachments and utility pipe chases and at wall/roof intersections. For most residential and some commercial EIFS, manufacturers now specify a weather-resistive barrier for additional protection from moisture that penetrates the wall. In addition, manufacturers of windows, doors, flashing and sealants offer instruction on proper installation and maintenance of their products. • EIMA (EIFS Industry Members Association), www.eima.com. This website has extensive information about proper installation of EIFS, sealants, flashing, proper attachment of EIFS to substrates, and inspection, maintenance and repair of EIFS claddings. • ASTM E2112-07, Standard Practice for Installation of Exterior Windows, Doors and Skylights • ASTM C1481-00 (2006), Standard Guide for Use of Joint Sealants with EIFS • ASTM C1397-05, Standard Practice for Application of EIFS Class PI • AWCI (Association of Wall and Ceiling Industry) offers EIFS Education and Certification Programs for EIFS applicators and also for building officials, inspectors and design professionals. Contractors whose personnel have successfully completed the AWCI EIFS training can be found on AWCI's "EIFSmart Construction National Registry." See www.awci.org.

Submittal Approvals:

Job Name	
Contractor	**Date**

Product Information
See usg.com for the most up-to-date product information.

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Safety First!
Follow good safety/industrial hygiene practices during installation. Wear appropriate personal protection equipment. Read MSDS and literature before specification and installation.

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SECTION 093000 - TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Waterproof and crack isolation membrane.
3. Metal edge strips.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch lengths.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.6 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Waterproof and crack isolation membrane.
2. Joint sealants.
3. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Porcelain Floor Tile CT1: Porcelain Floor Tile.

1. Manufacturer: Subject to compliance with requirements, provide product by the following:

a. Crossville, Inc.; Shades.

2. Composition: Porcelain.
3. Face Size: 12 by 24 inches.
4. Thickness: 10.5 mm.
5. Face: Plain with square edges.
6. Finish: UPS with Cross-Sheen® Finish.
7. Tile Color: Haze.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cove: Cove, 6 by 12 inch.

A. Wall Tile CT2: Decorative wall tile.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Daltile; Division of Dal-Tile International Inc.; Identity.

2. Module Size: 8 by 20 inches.
3. Thickness: 5/16 inch.
4. Face: Pattern of design indicated, with manufacturer's standard edges.
5. Tile Color: Bistro Cream.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 1 by 10 inches.

B. Wall tile CT3: Decorative marble mosaic tile.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Daltile; Division of Dal-Tile International Inc.; Marble Mosaic.

2. Module Size: 12 by 12 inches sheet (overall size).
3. Face: Pattern of design indicated, with manufacturer's standard edges.
4. Tile Color: DA92 Warm Waterfall Blend.

5. Grout Color: As selected by Architect from manufacturer's full range.

C. Ceramic Floor Tile CT4: Factory-mounted unglazed ceramic mosaic tile.

1. Manufacturer: Subject to compliance with requirements, provide product by the following:

a. Daltile; Division of Dal-Tile International Inc.; Keystone Mosaic.

2. Composition: Porcelain.
3. Module Size: 2 by 2 inches.
4. Thickness: 1/4 inch.
5. Face: Plain with cushion edges.
6. Surface: Smooth, without abrasive admixture.
7. Tile Color and Pattern: Suede Gray Speckle.
8. Grout Color: As selected by Architect from manufacturer's full range.

D. Wall Tile CT5: Glazed wall tile.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Daltile; Division of Dal-Tile International Inc.; Lillis.

2. Module Size: 4 by 16 inches.
3. Thickness: 5/16 inch.
4. Face: Plain with cushion edges.
5. Tile Color: Gloss White.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4 by 16 inches.

E. Wall Tile CT6: Glass wall tile.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Daltile; Division of Dal-Tile International Inc.; Glass Reflections Tile.
b. Color, Size and type to be determined.

F. Wall Tile CT7: Decorative wall tile.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

a. Daltile; Division of Dal-Tile International Inc.; Torreon.

2. Module Size: 12 by 24 inches.
3. Thickness: 5/16 inch.
4. Face: Pattern of design indicated, with manufacturer's standard edges.
5. Tile Color and Pattern: Tortora TN96.
6. Grout Color: As selected by Architect from manufacturer's full range.

7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size 4 by 12 inches.

8. Concrete Floor and Wall Transition: Provide Schluter DILEX-AHKA trim, stainless steel finish.
9. Tile Floor and Wall Transition: Provide Schluter DILEX-AHKA/-PHK trim, stainless steel finish.
10. Outside Corners: Provide Schluter Jolly trim, stainless steel finish.

11. Floor Tile CT8: Manufacturer: Subject to compliance with requirements, provide products by the following:

    a. Daltile; Division of Dal-Tile International Inc.; Glass Reflections Tile.
    b. Color, Size and type to be determined.

G. Wall Tile CT8: Decorative wall tile base.

1. Manufacturer: Subject to compliance with requirements, provide products by the following:

    a. Daltile; Division of Dal-Tile International Inc.; Semi-Gloss.

2. Module Size: 4-1/4 by 4-1/4 inches.
3. Thickness: 5/16 inch.
4. Face: Pattern of design indicated, with manufacturer's standard edges.
5. Tile Color and Pattern: Suede Gray 0182.
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

    a. Cove base, module size 4-1/4 by 4-1/4 inches.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. C-Cure; C-Cure Board 990.
    b. Custom Building Products; Wonderboard.
    c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
    d. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch.

2.4 WATERPROOF AND CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and ANSI A118.12, and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Products: Subject to compliance with requirements, provide the following:

a. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane. (2.39 g/L)
b. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh. (31 g/L)

2.5 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Laticrete International, Inc.
f. MAPEI Corporation.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.6 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bonsal American; an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. Laticrete International, Inc.
f. MAPEI Corporation.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.7 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard sanded acrylic caulking containing a mildew-cide or antimicrobial protection.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

D. Products: Available products include the following:

1. Keracaulk™ S by Mapei
2. CeramaSeal by Bostik Findley

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors composed of tiles 8 by 8 inches or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned

joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. 1/8 inch, typical unless noted otherwise.
2. CT2: 1/16 inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING & CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over membrane until membrane has cured.

3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.

a. Tile Type: As indicated.
b. Thin-Set Mortar: Latex- portland cement mortar.
c. Grout: Polymer-modified unsanded grout.

B. Interior Wall Installations, Masonry or Concrete:

1. Tile Installation W202: Thin-set mortar; TCA W202.

a. Tile Type: As indicated.
b. Thin-Set Mortar: Latex- portland cement mortar.
c. Grout: Polymer-modified unsanded grout.

C. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W244: Thin-set mortar on cementitious backer units; TCA W244.

a. Tile Type: As indicated.
b. Thin-Set Mortar: Latex- portland cement mortar.
c. Grout: Polymer-modified unsanded grout.

D. Shower Receptor and Wall Installations, Concrete or Masonry:

1. Tile Installation B421: Thin-set mortar on waterproof membrane; TCA B421.

    a. Tile Type: As indicated.
    b. Thin-Set Mortar: Latex-portland cement mortar.
    c. Grout: Polymer-modified unsanded grout.

E. Shower Receptor and Wall Installations, Metal Studs or Furring:

1. Tile Installation B415: Thin-set mortar on cementitious backer units; TCA B415.

    a. Tile Type: As indicated.
    b. Thin-Set Mortar: Latex-portland cement mortar.
    c. Grout: Polymer-modified unsanded grout.

END OF SECTION 093000

KEYSTONES™

COLORBODY™ PORCELAIN

SPA D148 (1)
⬣

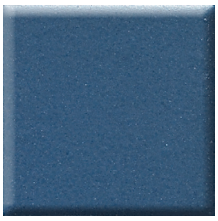
AEGEAN D192
▲

AQUA GLOW D197 (3) *

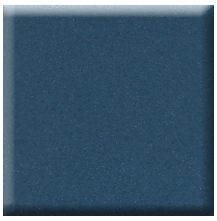
OCEAN BLUE D159 (4)
▲

SEA SPEC D372 (3)
■

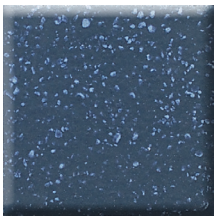
WATERFALLD169 (1)
▲



GALAXY D023 (4)
⬣ ▲



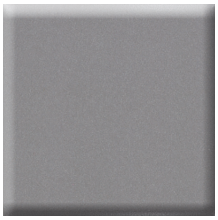
NAVY D189 (4)



NAVY SPECKLE D209 (4)
■

DESERT GRAY D014 (1)
⬣ ▲

DESERT GRAY SPECKLE
D200 (1) ■ ▲



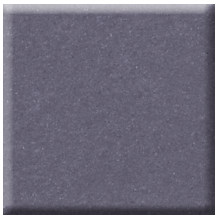
SUEDE GRAY D182 (2)
▲

SUEDE GRAY SPECKLE
D208 (2) ■ ▲

BLACK D311 (3)
⬣ ▲ ■

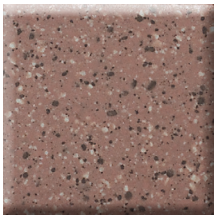
CARNATION PINK
D095 (4) *

CARNATION PINK
SPECKLE D205 (4) ■



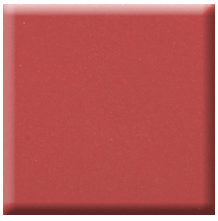
DEEP PURPLE D044 (4)
⬣ *

FIRE BRICK D093 (3) ■
▲



FIRE BRICK SPECKLE
D203 (3) ▲

CINNAMON RANGE
D007 (3) ⬣ ▲



RED D017 (5) ★

(1), (2), (3), (4) and (S) indicate Price Groups, (1) being the least expensive.
■ 3" Unglazed available (Groups (3) and (4) are made-to-order
⬣ 1" Hexagon available
▲ Available in Keystones Shapes; Keystones Shapes made-to-order
★ Red D017 is made-to-order only; no trim available
* Made-to-order

All colors available in 1" and 2" Unglazed surface.
All colors available in 1" and 2" size with Abrasive content on a made-to-order basis with the exception of Red D017.
All colors available in 2" Keystone Tread Surface on a made-to-order basis with the exception of Red D017 and D044 Deep Purple.

KEYSTONES™ | COLORBODY™ PORCELAIN

KEYSTONES SIZES

			SQ. FT. PER CARTON	PIECES PER CARTON
	3 x 3 Mosaic (Dot-mounted on 1' x 2' sheet)	(Sheet 11-15/16" x 24") (Sheet 30.28 cm x 60.91 cm)	24.24	12
	2 x 2 Mosaic (Dot-mounted on 1' x 2' sheet)	(Sheet 11-7/8" x 23-7/8") (Sheet 30.23 cm x 60.71 cm)	24	12
	1 x 1 Mosaic (Dot-mounted on 1' x 2' sheet)	(Sheet 11-7/8" x 23-7/8") (Sheet 30.23 cm x 60.71 cm)	24	12
	1 x 1 Hexagon (Dot-mounted on 1' x 2' sheet)	(Sheet 11-5/8" x 22-5/8") (Sheet 29.5 cm x 57.0 cm)	21	12

KEYSTONES BLENDS SIZES

			SQ. FT. PER CARTON	PIECES PER CARTON
	2 x 2 Field Tile (1' x 2' sheet)	(Sheet 11-7/8" x 23-7/8") (Sheet 30.23 cm x 60.9 cm)	24	12
	1 x 2 Field Tile (1' x 2' sheet)	(Sheet 11-7/8" x 23-7/8") (Sheet 30.23 cm x 60.9 cm)	24	12
	1 x 1 Field Tile (1' x 2' sheet)	(Sheet 11-7/8" x 23-7/8") (Sheet 30.23 cm x 60.9 cm)	24	12

KEYSTONES SHAPES SIZES

			SQ. FT. PER CARTON	PCS. PER CARTON
	2" Octagon and 1" Dot (1' x 2' sheet)	(Sheet 12-15/16" x 24-5/8") (Sheet 32.8 cm x 62.6 cm)	27.74	15
	2" Hexagon (1' x 2' sheet)	(Sheet 12-15/16" x 24-5/8") (Sheet 32.8 cm x 62.6 cm)	30.32	15
	1-1/4" Hexagon (1' x 2' sheet)	(Sheet 11-1/4" x 23-1/4") (Sheet 26.7 cm x 59.0 cm)	20.33	12
	1" Penny Round (1' x 2' sheet)	(Sheet 11" x 22-7/8") (Sheet 27.9 cm x 58.0 cm)	19.76	12
	2 x 1 Oblong (1' x 2' sheet)	(Sheet 11" x 22-7/8") (Sheet 27.9 cm x 58.0 cm)	24	12
	1 x 1 Rounded Corner (1' x 2' sheet)	(Sheet 11" x 23-7/8") (Sheet 30.2 cm x 60.7 cm)	24	12
	3/4 x 3/4 Square (1' x 2' sheet)	(Sheet 11-7/8" x 23-1/4") (Sheet 30.0 cm x 60.0 cm)	23.60	12
	2 x 1 Oblong Brickwork (1' x 2' sheet)	(Sheet 11-7/8" x 22-7/8") (Sheet 30.0 cm x 58.0 cm)	22	12
	1" Rounded Corner Brickwork (1' x 2' sheet)	(Sheet 11-7/8" x 22-7/8") (Sheet 30.0 cm x 58.0 cm)	23.60	12

RESIDENTIAL USAGE

FLOORS	WALLS	COUNTERTOPS	EXTERIOR PATIOS	EXTERIOR POOL DECKS
F	W	C	EP	ED

SHADE VARIATION

LOW (V1) to HIGH (V3)*
* Speckled and Mottled colors have High/Random shading.

INSTALLATION

THICKNESS	GROUT JOINT RECOMMENDATION
1/4"	1/8" Approximately

SLIP RESISTANCE (WET) : 3

The higher the rating, the higher the slip resistance.

1	< .50
2	.50 - .59
3	≥ .60

COMMERCIAL USAGE

	INTERIOR			EXTERIOR	
	RESIDENTIAL	LIGHT COMMERCIAL	COMMERCIAL	RESIDENTIAL	COMMERCIAL
Floors/Patios	✓	✓	✓	✓	✓
Walls/Backsplashes	✓	✓	✓	✓	✓
Countertops	✓	✓	✓	✓	✓
Pool Decking	✓	✓	✓	✓	✓
Pool Linings	✓	✓	✓	✓	✓

Suitable for freezing and non-freezing climates when proper installation methods are followed.

TEST RESULTS

	ASTM#	RESULT
Water Absorption	C373	< 0.5%
Breaking Strength	C648	> 300 lbs
Scratch Hardness	MOHS	6.0-7.5
Chemical Resistance	C650	Resistant
Coefficient of Friction	C1028	Wet: ≥ 0.60 Dry: ≥ 0.70
Abrasion Resistance	C1028	Wet: ≥ 0.68 Dry: ≥ 0.73

TRIM

TYPE	NUMBER	SIZE	KEYSTONES™
Bullnose	S-862	1 x 1	Groups 1, 2, 3
Bullnose	S-886	2 x 2	●
Bullnose	S-4339	3 x 3	● ✦
Bullnose Corner	SC-862	1 x 1	Groups 1, 2, 3
Bullnose Corner	SC-886	2 x 2	●
Bullnose Corner	SN-4339	3 x 3	Groups 1, 2, 3, 4 ✦
Cove	C-103	1/2 x 3	Groups 1, 2
Cove Inside Finger	CC-103	1/2 x 3	Groups 1, 2
Cove Base	A-3331	3 x 3	Groups 1, 2
Cove Base	C-813	1 x 1	Groups 1, 2, 3
Cove Base	C-833	2 x 2	Groups 1, 2, 3
Cove Base Corner	CB-813	1 x 1	Groups 1, 2, 3
Cove Base Corner	CK-813	1 x 1	Groups 1, 2, 3
Cove Base Corner	SB-103	1 x 3	Groups 1, 2
Cove Base Corner	SB-816	2 x 2	Groups 1, 2, 3
Cove Base Corner	SC-816	2 x 2	Groups 1, 2, 3
Outcorner	SCRL-833	2 x 1	Groups 1, 2, 3
Outcorner	SCR-L-3331	3 x 3	Groups 1, 2
Universal Trim	S-812	1 x 1	Groups 1, 2, 3 ■
Universal Trim	S-832	2 x 2	Groups 1, 2, 3
Universal Trim	SC-813/SU-813	2 x 2	Groups 1, 2, 3
Universal Trim	C-701	1 x 1	Groups 1, 2, 3, 4 ■

■ Made-to-order

✦ 3 x 3 Group 3 & 4 and trim made-to-order.

● Available in all groups.

NOTES

Special care should be taken when grouting with dark pigmented colors. A grout release is recommended to prevent finely powdered pigments from lodging in the pores of the tile surface. Use of a latex modified thin-set is recommended for installation.

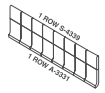
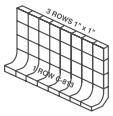
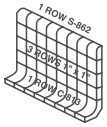
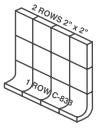
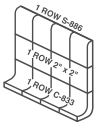
Strong random shading enhances the natural beauty of this product. To achieve optimal results, tile should be selected from multiple cartons and shading arrangement planned prior to installation.

Since there are variations in all fired ceramic products, tile and trim supplied for your particular installation may not match these samples. Final color selection should be made from actual tiles and trim and not from tile and trim samples or color reproductions. Manufactured in accordance with ANSI A 137.1 standards.

For additional information, refer to "Factors to Consider" at www.daltile.com/CommercialFactors.

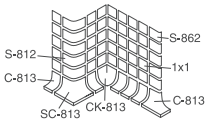
Water, oil, grease, etc. create slippery conditions. Floor applications with exposure to these conditions require extra caution in product selection. Not for use on ramps.

BUILD-UP BASE

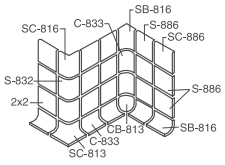
TYPE	NUMBER	SIZE	KEYSTONES™
 Built-up Base	MB-3T	(1) Row A-3331 (1) Row S-4339	Groups 1, 2 3 x 3 colors
 Built-up Base	MB-4C	(3) Rows 1 x 1 (1) Row C-813	Groups 1, 2, 3
 Built-up Base	MB-5	(1) Row S-862 (3) Rows 1 x 1 (1) Row C-813	Groups 1, 2, 3
 Built-up Base	MB-5A	(2) Rows 2 x 2 (1) Row C-833	Groups 1, 2, 3
 Built-up Base	MB-5B	(1) Row S-886 (1) Row 2 x 2 (1) Row C-833	Groups 1, 2, 3

SURFACE TRIM (TYPICAL INSTALLATION)

1 x 1 Thinset Bed

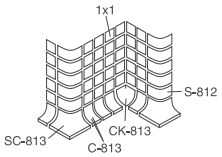


2 x 2 Thinset Bed

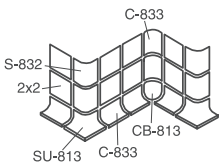


UNIVERSAL TRIM (TYPICAL INSTALLATION)

1 x 1 Conventional Mortar Bed



2 x 2 Conventional Mortar Bed



Shades by Crossville™

PORCELAIN STONE

- 9 contemporary colors in two finishes - Honed and UPS with Cross-Sheen® Finish
- Sizes offered 24 x 24, 12 x 24, and 6 x 24 and 1 x 3 Honed Stacked Mosaics in warm, cool or white combinations and 1 x 3 Mosaic Border in two metallic finishes
- Trim includes 4 x 24 single bullnose and 6 x 12 cove base
- Field tile is rectified with 3mm grout joint
- 20% Pre-Consumer Recycled Content makes it one of Crossville's Beautifully Green Alternatives™
- Three standard sizes that can be complemented with planks through the Get Planked® program
- Made in the U.S.A.

AV241 Frost UPS

AV241 Frost Honed

AV242 Vapor UPS

AV242 Vapor Honed


AV243 Fog UPS


AV243 Fog Honed


AV244 Mist UPS


AV244 Mist Honed


AV245 Clay UPS


AV245 Clay Honed


AV246 Ash UPS


AV246 Ash Honed


AV247 Haze UPS

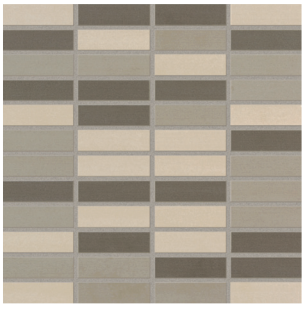

AV247 Haze Honed

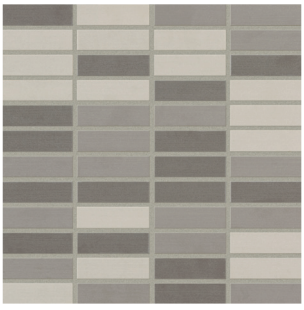

AV248 Thunder UPS


AV248 Thunder Honed


AV249 Ink UPS


AV249 Ink Honed


SBC1/.10103HMOS Warm Grays


SBC2/.10103HMOS Cool Grays

SBC3/.10103HMOS Whites


SBC1/.10212MT Luster


SBC2/.10212MT Shine

Crossville, Inc. • P.O. Box 1168,Crossville, TN 38557
Phone: 931.484.2110 • Fax: 931.456.2956
E-Mail: Crossc@CrossvilleInc.com • **CrossvilleInc.com**

CROSSVILLE®
ELEVATE YOUR SPACE

Shades by Crossville™

Sizes

Nominal (in)	Actual (mm)	Thickness (mm)	Finish
6 x 24	147 x 597	10.5	UPS/HON
12 x 24	297 x 597	10.5	UPS/HON
24 x 24	597 x 597	10.5	UPS/HON

Note: All field tile is rectified and modular with a 3mm grout joint.

Mosaics and Mosaic Border

Nominal (in)	Actual (mm)	Sheet (mm)	Thickness (mm)	Finish
1 x 3 Mosaics*	22 x 72	297 x 297	10.5	HON
1 x 3 Mosaic Border**	22 x 72	47 x 334.5	10.5	Metallic

*1 x 3 honed mosaics mesh mounted in 11-7/8 x 11-7/8 sheets.

** Mounted on a 2 x 13 sheet. Globally sourced.

Coordinating Trim (Available in all colors)

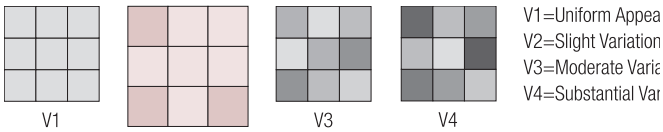
Nominal (in)	Actual (mm)	Thickness (mm)	Finish
4 x 24 Single Bullnose	97 x 597	10.5	UPS
6 x 12 Cove Base	150 x 297	10	UPS

Sizes Available (shown in AV249 Ink UPS)

24 x 24 | 12 x 24 | 6 x 24

Shade & Texture Index

Shades by Crossville™ has a shade variation of V2.



V1 | V2 | V3 | V4

V1=Uniform Appea
V2=Slight Variation
V3=Moderate Varia
V4=Substantial Var

Product Performance

Breaking Strength	>500 lbf	ASTM C648
Bond Strength	>200 psi	ASTM C482
Chemical Resistance	Unaffected	ASTM C650
Frost Resistance	Resistant	ASTM C1026
Water Absorption	<0.30%	ASTM C373
Scratch Hardness	7	Mohs Scale

Coefficient of Friction

UPS Dry	>0.8	ASTM C1028
Wet	>0.6	ASTM C1028
HON Dry	>0.6	ASTM C1028
Wet	NA	ASTM C1028

Care and Maintenance

Regular cleaning is the best way to keep Shades by Crossville™ tile looking good for years to come. Use clean, hot water (combined with a household cleaner for more aggressive cleaning). Rinse thoroughly and dry with a soft cloth. No waxes are needed. More information regarding the care and maintenance of Crossville® products is available at Crossvillelnc.com.

Recommended Use – UPS & Honed

Shades by Crossville™ is recommended for interior floors, walls, countertops, and exterior walls in both residential and commercial applications. Shades by Crossville™ is not recommended for exterior horizontal surfaces or exterior paving. The honed tile is not recommended for wet areas where standing water may occur. If offset pattern is required for tiles 18 inches or longer, Crossville® recommends an offset of not greater than 33%. See Crossvillelnc.com for detailed installation instructions

Wet Area Use for Shades by Crossville™ 1" x 3" Honed Mosaics

Crossville® produces the Shades by Crossville™ mosaics with a honed finish. They exceed current ADA guidelines and deliver a wet static coefficient of friction equal to or greater than 0.6 on the surface of the tile. Their small 1" x 3" size ensures frequent grout joints which provides traction and drainage. Crossville cannot control situations involving incorrect installation, improper slope to the drain for elimination of standing water and poor surface cleaning. This information is provided so that customers may make a realistic and informed decision when comparing Shades by Crossville™ to other tile products in wet area environments, such as residential/commercial bathrooms, showers, and interior pool decks.

EcoCycle Tile Process™

Shades by Crossville™ contains a minimum of 20 percent pre-consumer recycled content and is manufactured by Crossville® using processes that have been certified by Scientific Certification Systems. SCS has verified that through these recycling processes Crossville recycles nearly 12 million pounds of previously discarded filtrate and fired tile waste. In addition to its own fired waste recycling, Crossville also accepts and recycles reclaimed, previously installed tile through its Tile Take-Back™ Program. For more information, visit Crossvillelnc.com/green.

Product featured in photo above: AV249 Ink 6" x 24" Honed, AV249 Ink 12" x 24" UPS

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Phone: 931.484.2110 • Fax: 931.456.2956
E-Mail: Crossc@CrossvilleInc.com • **CrossvilleInc.com**

Product featured: Shades by Crossville™ AV244 Mist 12” x 24” Honed, AV246 Ash 12” x 24” Honed, AV248 Thunder 12” x 24” Honed, AV249 Ink 6” x 12” Honed

GLAZED CERAMIC / COLORBODY™ PORCELAIN

IDENTITY™ FLOOR/WALL

daltile®

DESIGN WITH CONFIDENCE™

IDENTITY™ WALL
IDENTITY™ FLOOR

GLAZED CERAMIC
COLORBODY™ PORCELAIN

floor • wall • countertop

Envelop your space with the contemporary elegance of Identity Floor, a ColorBody™ porcelain tile with three unique surfaces. Fabric resembles fine tweed with subtle grains and metallic specks. Grooved mirrors the depth of raked sand. Cement embodies the modern style of a cement-look, combined with movement and variation. This line contains a vast range of colors, sizes, and finishes that can bring to life the "identity" of your space.

Add more personality to your space with the addition of Identity Wall. Available in the same seven coordinating colors as the floor tile, this wall line comes in a contemporary 8 x 20 size, which is available in gloss and matte finishes. A coordinating gloss and matte decorative accent is also available in each color and is sure to make a subtle yet memorable statement.

Cover photo features Imperial Gold, Fabric (Unpolished) 12 x 24 and 24 x 24 field tile on the floor. Wall features Imperial Gold, Gloss 8 x 20 wall tile and decorative accent.

Photo features Paramount White Matte 8 x 20 wall tile in a diagonal grid pattern on the wall. Floor features Twilight Black Grooved (Unpolished) 12 x 24 field tile in a grid pattern.

IDENTITY™ FLOOR | COLORBODY™ PORCELAIN

floor • wall • countertop

Floor Tile

FABRIC (LIGHT POLISHED & UNPOLISHED)

METRO TAUPE MY22

Close-up of Fabric Tile

PARAMOUNT WHITE MY20

BISTRO CREAM MY21

IMPERIAL GOLD MY23

OXFORD BROWN MY24

CASHMERE GRAY MY25

TWILIGHT BLACK MY26

GROOVED (12 X 24 ONLY - LIGHT POLISHED & UNPOLISHED)

METRO TAUPE MY32

Close-up of Grooved Tile

PARAMOUNT WHITE MY30

BISTRO CREAM MY31

IMPERIAL GOLD MY33

OXFORD BROWN MY34

CASHMERE GRAY MY35

TWILIGHT BLACK MY36

CEMENT (18 X 18 ONLY - UNPOLISHED ONLY)

METRO TAUPE MY42

Close-up of Cement Tile

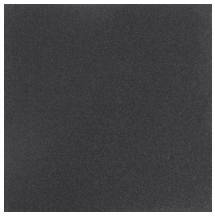
PARAMOUNT WHITE MY40

BISTRO CREAM MY41

IMPERIAL GOLD MY43

OXFORD BROWN MY44

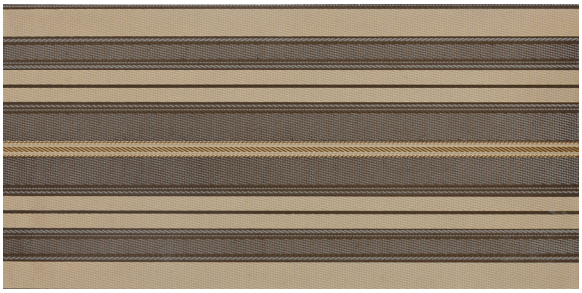
CASHMERE GRAY MY45

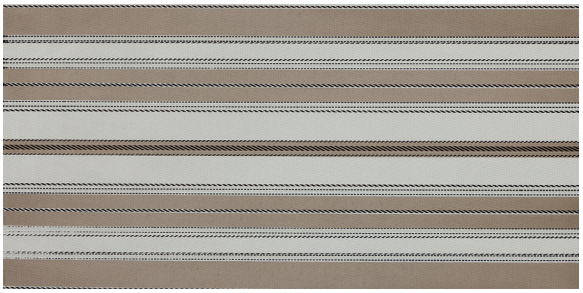


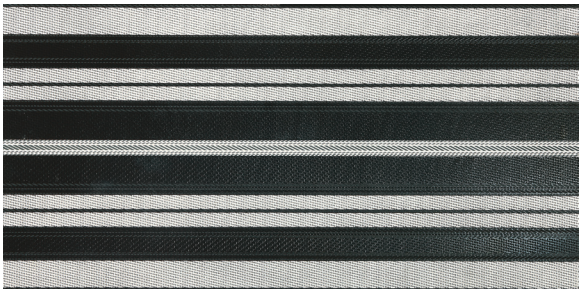
TWILIGHT BLACK MY46

Floor Decorative Accents (Available in Unpolished Fabric only)


CREAM/BROWN MY51

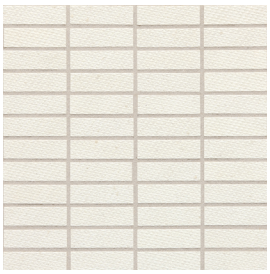

GOLD/BROWN MY53


TAUPE/TAN MY52


WHITE/BLACK MY50


GRAY/BLACK MY54

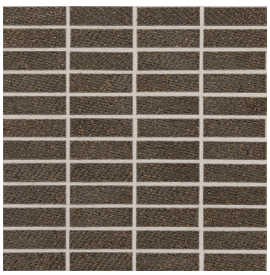
Mosaics (Available in Unpolished Fabric only)


PARAMOUNT WHITE MY20

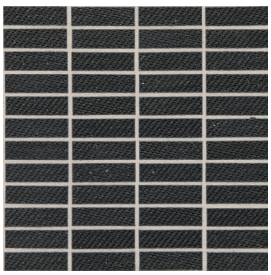

BISTRO CREAM MY21


METRO TAUPE MY22


IMPERIAL GOLD MY23


OXFORD BROWN MY24


CASHMERE GRAY MY25


TWILIGHT BLACK MY26

IDENTITY™ WALL | GLAZED CERAMIC

floor • wall • countertop

Wall Field Tile (All colors are also available in Gloss Field Tile)


MATTE PARAMOUNT WHITE MY67


MATTE BISTRO CREAM MY69


MATTE METRO TAUPE MY71


MATTE IMPERIAL GOLD MY70


MATTE CASHMERE GRAY MY72


MATTE OXFORD BROWN MY73


MATTE TWILIGHT BLACK MY68

Wall Decorative Accents (All colors are also available in Gloss Decorative Accents)


MATTE PARAMOUNT WHITE MY67


MATTE BISTRO CREAM MY69


MATTE METRO TAUPE MY71


MATTE IMPERIAL GOLD MY70


MATTE CASHMERE GRAY MY72


MATTE OXFORD BROWN MY73


Close-up of Wall Decorative Accent


MATTE TWILIGHT BLACK MY68

Photo features Oxford Brown (Light Polished) 24 x 24 field tile on the floor and Oxford Brown Gloss 8 x 20 wall tile and Gloss decorative accent on the wall.

IDENTITY™ FLOOR | COLORBODY™ PORCELAIN

SIZES

		SQ.FT. CARTON	PCS. PER CARTON
24 x 24 Field Tile (Fabric only)	23-1/2" x 23-1/2" (59.8 cm x 59.8 cm)	15.49	4
12 x 24 Field Tile* (Fabric & Grooved)	11-3/4" x 23-1/2" (29.8 cm x 59.8 cm)	11.62	6
18 x 18 Field Tile** (Fabric & Cement)	17-5/8" x 17-5/8" (44.8 cm x 44.8 cm)	13.07	6
12 x 12 Field Tile (Fabric only)	11-3/4" x 11-3/4" (29.8 cm x 29.8 cm)	11.62	12
1 x 3 Mosaic (Mesh-mounted) (Unpolished Fabric only)	Sheet: 11-3/4" x 11-3/4" (29.8 cm x 29.8 cm)	9.00	9
12 x 24 Decorative Accent	11-3/4" x 23-1/2" (29.8 cm x 59.8 cm)	--	4

■ Grooved available in 12 x 24 unpolished and light polished only.

▲ Cement available in 18 x 18 unpolished only.

LINEAR OPTIONS™ SIZES

		SQ.FT. CARTON	PIECES PER CARTON
6 x 24 Field Tile	6" x 23-1/2" (14.63 cm x 59.8 cm)	10.65	11
4 x 24 Field Tile	4" x 23-1/2" (9.73 cm x 59.8 cm)	6.46	10
2 x 24 Field Tile	2" x 23-1/2" (4.67 cm x 59.8 cm)	6.66	20

Additional linear and rectangular sizes available through Linear Options™, Daltile's linear cutting service. Visit www.daltile.com/linearoptions for sizes and order information.

RESIDENTIAL USAGE

FLOORS	WALLS	COUNTERTOPS	EXTERIOR PATIOS	EXTERIOR POOL DECKS
F	W	C	EP**	ED*

All surfaces are suitable for pool linings.
*Fabric Unpolished surface only.
**Unpolished only.

COMMERCIAL USAGE

	INTERIOR			EXTERIOR	
	RESIDENTIAL	LIGHT COMMERCIAL	COMMERCIAL	RESIDENTIAL	COMMERCIAL
Floors/Patios	✓	✓	✓*	✓*	✓*
Walls/Backsplashes	✓	✓	✓	✓	✓
Countertops	✓	✓	✓	✓	✓
Pool Decking**					
Pool Linings	✓	✓	✓	✓	✓

* Unpolished only

** Fabric (Unpolished only)

FABRIC (Unpolished only): Suitable for exterior patios (including pool decks) and walls in freezing and non-freezing climates when proper installation methods are followed.

GROOVED: Suitable for exterior patios (excluding pool decks) and walls in freezing and non-freezing climates when proper installation methods are followed.

CEMENT: Suitable for exterior walls in freezing and non-freezing climates when proper installation methods are followed.

TRIM

TYPE		NUMBER	SIZE	PCS. PER CARTON
	Bullnose (Fabric) (Light Polished & Unpolished)	S-44C9	4 x 12	30
	Bullnose (Grooved) (Light Polished & Unpolished)	S-44F9	4 x 24	10
	Bullnose (Cement) (Unpolished)	S-44H9	4 x 18	10
	Cove Base (Fabric)	S-36C9TB	6 x 12	30
	Cove Base Outcorner (Fabric)	SC-36C9T	1 x 6	15

SHADE VARIATION

MEDIUM (V2)
Color variation within each tile.

INSTALLATION

THICKNESS	GROUT JOINT RECOMMENDATION
3/8"	1/8" (3/16" when rectangular sizes are used in a staggered brick-joint pattern, where the overlap does not exceed 33%)

SLIP RESISTANCE (WET) : 2 & 3

The higher the rating, the higher the slip resistance.

1 < .50

2 .50 - .59 (Light Polished)

3 ≥ .60 (Unpolished)

TEST RESULTS (Unpolished only)

	ASTM#	RESULT
Water Absorption	C373	< 0.5%
Breaking Strength	C648	> 550 lbs
Scratch Hardness	MOHS	8.0 (6.0 for Twilight Black)
Chemical Resistance	C650	Resistant
Coefficient of Friction (Unpolished)	C1028	Wet: ≥0.60 Dry: ≥0.70
Coefficient of Friction (Light Polished)	C1028	Wet: ≥0.50 Dry: ≥0.60

NOTES

Identity Fabric (Light Polish Surface) **Please Read Carefully**
Note to Tile Installer: This product is directional by design and MUST be installed with the arrows on the back of each tile facing in the same direction.

Special care should be taken when grouting with dark pigmented colors. A grout release is recommended to prevent finely powdered pigments from lodging in the pores of the tile surface. Use of a latex modified thin-set is recommended for installation.

Since there are variations in all fired ceramic products, the tile and trim supplied for your particular installation may not match these samples. Final color selection should be made from actual tiles and trim and not from tile and trim samples or color reproductions. Manufactured in accordance with ANSI A137.1 standards.

For additional information refer to "Factors to Consider" at: www.daltile.com/CommercialFactors

Water, oil, grease etc. create slippery conditions. Floor applications with exposure to these conditions require extra caution in product selection. Not for use on ramps.

IDENTITY™ WALL | GLAZED CERAMIC

SIZES

		SQ.FT. CARTON	PCS. PER CARTON
8 x 20 Field Tile	7-1/8" x 19-9/32" (20.0 cm x 50.0 cm)	15.06	14
8 x 20 Decorative Accent	7-1/8" x 19-9/32" (20.0 cm x 50.0 cm)	--	14

RESIDENTIAL USAGE

FLOORS	WALLS	COUNTERTOPS	EXTERIOR PATIOS	EXTERIOR POOL DECKS
F	W	C*	EP	ED

Suitable for non-freezing climates when proper installation methods are followed.

*Dark colors may show scratches.

COMMERCIAL USAGE

	INTERIOR			EXTERIOR	
	RESIDENTIAL	LIGHT COMMERCIAL	COMMERCIAL	RESIDENTIAL	COMMERCIAL
Floors/Patios					
Walls/Backsplashes	✓	✓	✓	✓	✓
Countertops*	✓	✓	✓	✓	✓
Pool Decking					
Pool Linings	✓	✓	✓	✓	✓

Suitable for exterior walls in non-freezing climates when proper installation methods are followed.

* Dark colors may show scratches.

TRIM

TYPE	NUMBER	SIZE	PCS. PER CARTON
Jolly	S-5810J	1 x 10	14

SHADE VARIATION

MEDIUM (V2)
Color variation within each tile.

INSTALLATION

THICKNESS	GROUT JOINT RECOMMENDATION
5/16"	1/16"

TEST RESULTS

	ASTM#	RESULT
Water Absorption	C373	< 20.0%
Breaking Strength	C648	100-230 lbs
Scratch Hardness	MOHS	4.0-6.5
Chemical Resistance	C650	Resistant

NOTES

Special care should be taken when grouting with dark pigmented colors. A grout release is recommended to prevent finely powdered pigments from lodging in the pores of the tile surface. Use of a latex modified thin-set is recommended for installation.

Since there are variations in all fired ceramic products, the tile and trim supplied for your particular installation may not match these samples. Final color selection should be made from actual tiles and trim and not from tile and trim samples or color reproductions. Manufactured in accordance with ANSI A137.1 standards.

For additional information refer to "Factors to Consider" at: www.daltile.com/CommercialFactors

Water, oil, grease etc. create slippery conditions. Floor applications with exposure to these conditions require extra caution in product selection. Not for use on ramps.

IDENTITY™ WALL
IDENTITY™ FLOOR

GLAZED CERAMIC COLORBODY™ PORCELAIN

floor • wall • countertop

By their very design, Daltile products can help make it easier for you to earn LEED™ points and/or points towards many industry leading green home building programs. From using recycled material content to establishing manufacturing facilities within 500 miles of your project, we help ensure you don't have to compromise your design to be environmentally conscious. For detailed information, visit daltilegreenworks.com.

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LINEAR OPTIONS

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EXTERIOR PRODUCT

CERTIFIED PORCELAIN™ TILE
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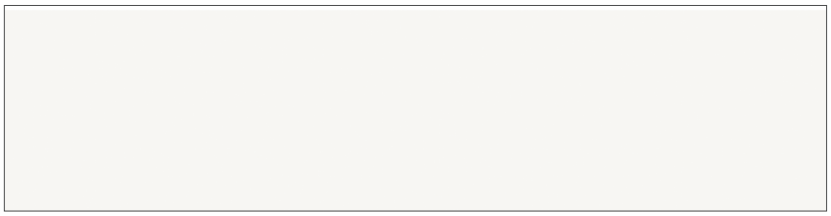
LILLIS™

Lillis glazed wall tile brings quality and versatility to any space. Available in two fresh colors, with the option of both gloss and matte finish, this line will complement any style. The large-format linear size is designed for a modern design visual, perfect for commercial projects and residential spaces.

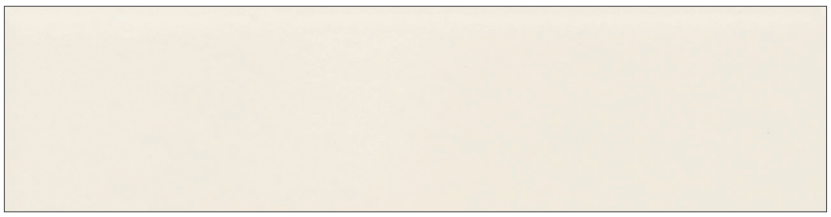
Field tile



GLOSS WHITE L001

MATTE WHITE L003

GLOSS IVORY L002



MATTE IVORY L004

GLAZED WALL TILE

LILLIS™

SIZES

		SQ. FT. CARTON	PIECES PER CARTON
4 x 16 Field Tile	(4" x 16") (10.16 cm x 40.6 cm)	11.1	25

RESIDENTIAL USAGE

FLOORS	WALLS	COUNTERTOPS	EXTERIOR PATIOS	EXTERIOR POOL DECKS
F	W	C	EP	ED

Suitable for exterior walls in non-freezing climates when proper installation methods are followed.

COMMERCIAL USAGE

	INTERIOR			EXTERIOR	
	RESIDENTIAL	LIGHT COMMERCIAL	COMMERCIAL	RESIDENTIAL	COMMERCIAL
Floors/Patios					
Walls/Backsplashes	✓	✓	✓	✓	✓
Countertops					
Pool Decking					
Pool Linings					

Suitable for exterior walls in non-freezing climates only when proper installation methods are followed.

NOTES

Use of a latex modified thin-set is recommended for installation.

Since there are variations in all fired ceramic products, tile and trim supplied for your particular installation may not match these samples. Final color selection should be made from actual tiles and trim and not from tile and trim samples or color reproductions. Manufactured in accordance with ANSI A 137.1 standards.

For additional information, refer to "Factors to Consider" at www.daltile.com/CommercialFactors.

TYPE

TYPE	NUMBER	SIZE	PCS. PER CARTON
Bullnose (on 16" side)	S-44D9	4 x 16	25
Bullnose (on 4" side)	S-4D49	4 x 16	25

SHADE VARIATION

LOW (V1)
Consistent color within each tile and from tile to tile.

INSTALLATION

THICKNESS	GROUT JOINT RECOMMENDATION
5/16"	1/8" when using staggered joint installations, overlap is not to exceed 33%

TEST RESULTS

	ASTM#	RESULT
Water Absorption	C373	< 20.0%
Breaking Strength	C648	> 120 lbs
Scratch Hardness	MOHS	4.0 - 6.5
Chemical Resistance	C650	Resistant

CERTIFIED PORCELAIN™ TILE
0.5% or less water absorption

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COLORBODY™ PORCELAIN | TORREON™

Cloud TN95
12 x 24 , 12 x 12

Tortora TN96
12 x 24 , 12 x 12

Cacao TN97
12 x 24 , 12 x 12

Brino TN98
12 x 24 , 12 x 12

Coal TN99
12 x 24 , 12 x 12

To view the complete collection of Daltile® products,
visit our website at www.daltileproducts.com.

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COLORBODY™ PORCELAIN | TORREON™

Sizes

		Sq. Ft. per carton	Pieces per carton
12 x 24 Field Tile	(11-13/16" x 23-5/8") (30.0 cm x 60.0 cm)	15.49	8
12 x 12 Field Tile	(11-13/16" x 11-13/16") (30.0 cm x 30.0 cm)	10.65	11

Trim

Type	Number	Size	Pieces per carton
Bullnose	S-44C9	4 x 12	30

Notes

Special care needs to be given when installing tiles 20" and larger. Please refer to www.daltileproducts.com/LargeTiles for information.

Special care should be taken when grouting with dark pigmented colors. A grout release is recommended to prevent finely powdered pigments from lodging in the pores of the surface. Use of a latex modified thin-set is recommended for installation.

Since there are variations in all fired ceramic products, the tile and trim supplied for your particular installation may not match these samples. Final color selection should be made from actual tiles and trim and not from tile and trim samples or color reproductions. Manufactured in accordance with ANSI A137.1 standards.

Application

	Residential	Light Commercial	Commercial	Commercial Exteriors
Floors	❖	❖	❖	
Walls/Backsplashes	❖	❖	❖	❖
Countertops	❖	❖	❖	❖
Pool Decking				
Pool Linings	❖	❖	❖	❖

Suitable for exterior walls in freezing and non-freezing climates when proper installation methods are followed.

Installation

Thickness	Grout Joint Recommendation	Shade Variation
3/8"	1/8" (3/16" when rectangular size is used in a staggered brick-joint pattern, where the overlap does not exceed 33%)	❖ Medium (V2)

Test Results

	ASTM#	Result
Water Absorption	C373	<0.5%
Breaking Strength	C648	>400 lbs
Scratch Hardness	MOHS	8.0
Chemical Resistance	C650	Resistant
Coefficient of Friction	C1028	Wet: ≥0.60 Dry: ≥0.70

For additional information refer to "Factors to Consider" at: www.daltile.com/CommercialFactors.

Water, oil, grease etc. create slippery conditions. Floor applications with exposure to these conditions require extra caution in product selection. Not for use on ramps.

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Innovative Installation Systems for Tile and Stone

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Cross-section view
Image Gallery
CAD Drawing

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Schluter®-DILEX-AHK/-PHK

Application and Function

Ceramic cove base represents a neat, hygienic method for treating transitions by providing a curved surface that prevents the collection of dirt and is easy to clean. However, the limited availability of ceramic trim pieces has resulted in the use of sealant and caulk to treat such transitions. These joints must be continually maintained throughout the life of the installation.

Schluter-DILEX-AHK/-PHK features a single trapezoid-perforated anchoring leg, which is secured in the mortar bond coat and a cove section that forms the visible surface.

The profile's 3/8" (10 mm) radius makes DILEX-AHK/-PHK an attractive option for countertop/backsplash transitions, as it prevents the accumulation of dirt and makes cleaning simple. The profile separates tile fields that meet at inside corners where limited movement is expected.

Schluter-DILEX-AHK/-PHK prevents surface water penetration and meets the maintenance and hygienic requirements of commercial kitchens, bathrooms, and food-processing plants, or any tiled environment where a sanitary cove base is desired.

Schluter-DILEX-AHK is available in anodized aluminum and Tuscan color-coated aluminum, while Schluter-DILEX-PHK is made of rigid PVC with a pre-colored, rigid PVC cove section. Accessories for DILEX-AHK/-PHK include: inside and outside corners, connectors, and end caps.

Related Articles

Ceramic Tile on Wood Floors (PDF, 868 KB)
Showcase of Innovation
Designing Fully Functional Tile Coverings for the North American Bathroom
The Maintenance-Free Bathroom

References

Tile Countertop - Residential Application

Innovative Installation Systems for Tile and Stone

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Schluter®-DILEX-AHKA

Application and Function

Schluter-DILEX-AHKA is an anodized aluminum, cove-shaped profile for transitions between walls to be tiled and previously finished floors. The profile features a single trapezoid-perforated anchoring leg that is secured in the mortar bond coat and a dovetailed channel, which can be bonded to floor surfaces using Schluter-KERDI-FIX, epoxy resin, silicone, thin-set mortar, etc. A 3/8" (10 mm) radius cove section forms the visible surface and prevents the accumulation of dirt, making cleaning simple. DILEX-AHKA prevents surface water penetration and meets the maintenance and hygienic requirements of commercial kitchens, bathrooms, and food-processing plants, or any tiled environment where a sanitary cove base is desired. DILEX-AHKA integrates with the Schluter-DILEX-AHK and Schluter-RONDEC profiles at 90° inside and outside vertical wall corners, respectively. Accessories for DILEX-AHKA include 90° and 135° inside and outside corners, and end caps.

Innovative Installation Systems for Tile and Stone

Zoom
Cross-section view
Image Gallery
CAD Drawing

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Schluter®-JOLLY

Application and Function

Schluter-JOLLY is a finishing and edge-protection profile for the outside corners of tiled surfaces.

It features a trapezoid-perforated anchoring leg that is secured in the mortar bond coat beneath the tile, and an 87° sloped vertical wall section that provides a decorative finish and protects adjacent tiles.

The profile is available in chrome-plated solid brass, color-coated aluminum, anodized aluminum, and PVC. Schluter-SCHIENE features the same design as Schluter-JOLLY and is also available in solid brass, aluminum, and stainless steel. Please see the Schluter-Systems Illustrated Price List for more details.

The range of available sizes and finishes permits the matching of Schluter-JOLLY to a wide variety of tile and grout colors and allows many design opportunities through the use of contrasting colors.

Other applications include transitions for dado coverings such as carpet, natural stone, or cold-cured resin coatings. The integrated joint spacer establishes a defined joint cavity between the tile and the profile.

Related Articles

Maximizing Ceramic Tile Installation with Trim Profiles
Installing a Granite Countertop Made Easy (PDF, 484 KB)
Tile Countertops: A Consumer's Perspective

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.

2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

C. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS (ACT 1)

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.; Fine Fissured Second Look, No. 1762.
2. BPB USA; Baroque Customline No. BQCL-448.
3. USG Interiors, Inc.; Radar ClimaPlus Illusion Four-48, No. 2882.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured) and K (surface scored).

C. Color: White.

D. LR: Not less than 0.80.

E. NRC: Not less than 0.55.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension system members.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 48 inches.

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.4 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (ACT 2)

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.; Fine Fissured No. 1729.
2. BPB USA; HHF-197.
3. USG Interiors, Inc.; Radar ClimaPlus No. 2410.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular or 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured) and I (embossed).

C. Color: White.

D. LR: Not less than 0.80.

E. NRC: Not less than 0.55.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Square.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 48 inches.

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.5 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (ACT 3)

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.; Clean Room VL; 868.
2. BPB USA; Vinyl Shield A; 1100-CRF-1.
3. USG Interiors, Inc.; Clean Room ClimaPlus Class 100, 56091.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
2. Pattern: E (lightly textured).

C. Color: White.

D. LR: Not less than 0.80.

E. NRC: NA.

F. CAC: Not less than 40.

G. Edge/Joint Detail: Square.

H. Thickness: 5/8 inch.

I. Modular Size: 24 by 24 inches.

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.6 ACOUSTICAL PANELS (ACT 4)

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong World Industries, Inc.; Second Look II, No. 1761.
2. BPB USA; Baroque Customline No. BQCL-224.
3. USG Interiors, Inc.; Radar ClimaPlus Illusion Two-24, No. 2842.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:

1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
2. Pattern: CE (perforated, small holes and lightly textured) and K (surface scored).

C. Color: White.

D. LR: Not less than 0.80.

E. NRC: Not less than 0.55.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension system members.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 48 inches.

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.7 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

    a. Type: Postinstalled expansion or postinstalled bonded anchors.
    b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.

D. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.

I. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

1. Available Products: UHDC by Armstrong or L15 by USG.

J. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including manufacturer's standard gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

2.8 METAL SUSPENSION SYSTEM

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Prelude 15/16" Exposed Tee System (7300 Series); Armstrong World Industries, Inc.

2. S11 System; Celotex Corporation.
3. 1200 System; Chicago Metallic Corporation.
4. DX 24 System; USG Interiors, Inc.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted white.

2.9 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Hangers shall be single lengths of wire without splices; coordinate lengths in deep ceiling cavities.
2. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-

system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

5. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.

1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

b. Install panels with pattern running in one direction parallel to long axis of space.
c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Install hold-down clips in areas within 10 feet of exterior doors or vestibule doors; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
6. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs acoustical panel ceilings, conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of acoustical panels until deficiencies have been corrected.

1. Complete the following in areas to receive gypsum board ceilings:

a. Installation of 80 percent of lighting fixtures, powered for operation.
b. Installation, insulation, and leak and pressure testing of water piping systems.
c. Installation of air-duct systems.
d. Installation of air devices.
e. Installation of mechanical system control-air tubing.
f. Installation of Penetration Firestopping and Fire-Resistive Joint Systems.

3.3 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

Recycled Content: Up to 35% armstrong.com/greengenie

LEED® Credits

Energy	Waste Mgmt	Recycled Content	Local Materials	Renewable Materials	Daylight & Views
✔	✔	✔	✔	✔	✔

Location Dependent

LEED for Schools

Acoustics	Low Emitting or CHPS
	✔

$$$$$

FINE FISSURED™ Second Look®

Scored Tegular

medium texture

10-YEAR Availability — Items 1760, 1761, 1762

Fine Fissured Second Look II with Suprafine® 9/16" Exposed Tee grid (Pg. 220)

Key Selection Attributes

- Geometric scored visuals
- Standard colors available (1760 & 1761 only)
- 30-Year Limited System Warranty against visible sag, mold/mildew, and bacterial growth

Typical Applications

- Department stores/retail
- Many types of commerical interiors

Color Selection

White (WH) | Cream (CR) | Haze (HA) | Camel (CM) | Platinum (PL)

Due to printing limitations, shade may vary from actual product.
Items 1760 and 1761 are available in colors. All other items are available in white only.
Colored ceilings are dye-lotted and should be segregated by dye lot. Do not mix.

Visual Selection

Performance Selection

Dots represent highest level of performance.

Edge Profile	Grid Drawings Cat. pgs. 226-228 or armstrong.com/catdwg	Item No.	Dimensions		UL Classified Acoustics NRC	CAC	Fire Rating	Light Reflect	Sag Resist	Anti-Microbial	Durable	Recycle Program
FINE FISSURED Second Look												
9/16" Angled Tegular	28	**1765**	2' x 4' x 3/4"	Second Look I	0.55	30	Class A	0.84 •	HumiGuard+ •	BioBlock+ •	Standard	Yes •
	28	**1766**	2' x 4' x 3/4"	Second Look II	0.55	30	Class A	0.84 •	•	•	Standard	•
15/16" Angled Tegular	5	**1760**	2' x 4' x 3/4"	Second Look I	0.55	35	Class A	0.84 •	•	•	Standard	•
	5	**1761** **1761M**	2' x 4' x 3/4" 600 x 1200 x 22mm	Second Look II	0.55	35	Class A	0.84 •	•	•	Standard	•
	5	**1762**	2' x 4' x 3/4"	Second Look III	0.55	35	Class A	0.84 •	•	•	Standard	•

Suspension Systems

15/16" Prelude®

9/16" Suprafine®

Physical Data

Material
Wet-formed mineral fiber

Surface Finish
Factory-applied latex paint

Fire Performance
ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled)

ASTM E1264 Classification
Type III, Form 2, Pattern C E K
Fire Class A

Sag Resistance
HumiGuard® Plus – superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.

VOC/Formaldehyde Emissions
Meets CA Dept. of Health Services Standard Practice for the testing of VOC Emissions and is listed on CHPS High Performance Products Database for Low-Emitting Materials.

Anti Mold/Mildew & Bacteria
BioBlock® Plus contains an anti-microbial treatment and provides guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.

Insulation Value
R Factor – 1.6 (BTU units)
R Factor – 0.28 (Watts units)

30-Year Performance Guarantee & Warranty Information
Details in back of catalog or at armstrong.com/warranty

Weight; Square Feet/Carton
0.75 lbs/SF; 80 SF/ctn

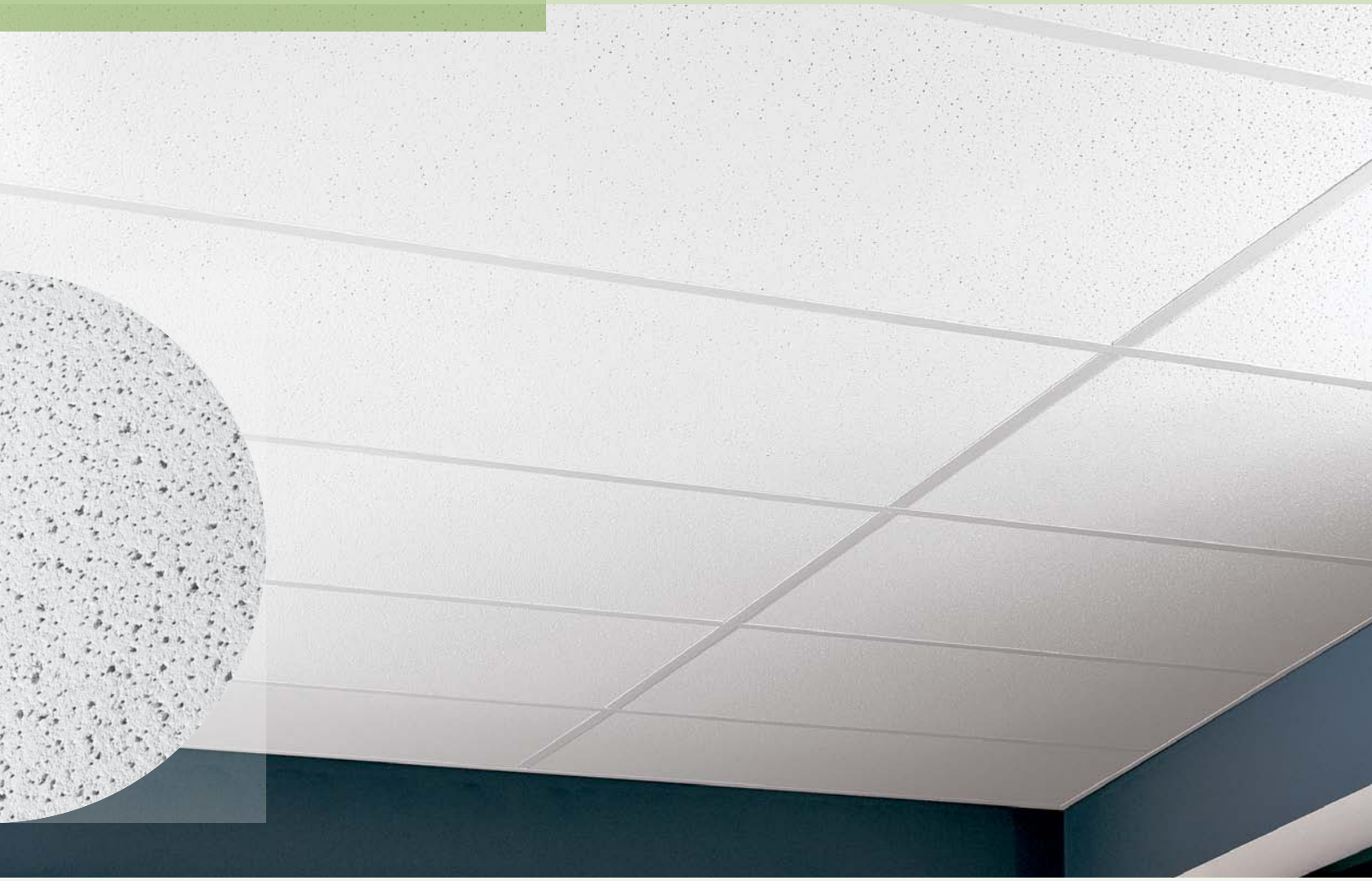
FINE FISSURED™

Square Lay-in

medium texture

10-YEAR Availability

Items 1713, 1714, 1728, 1729, 1736, 1737, 1738, 1830 & 1831



Fine Fissured with Prelude® 15/16" Exposed Tee grid (Pg. 215)

Key Selection Attributes

- Excellent sound absorption – Products help comply with ANSI S12.60 Classroom Guidelines: Items 1713, 1714, 1810, 1811
- Economical
- Non-directional visual reduces installation time and scrap
- For high durability Fine Fissured ceilings designed for schools, refer to School Zone™ Fine Fissured, pg. 177
- 30-Year Limited System Warranty against visible sag (excludes item 1738), mold/mildew, and bacterial growth

Typical Applications

- Schools
- Healthcare – assists in addressing HIPAA and FGI acoustical requirements (High Acoustics items only)
- Libraries/band rooms
- Corridors

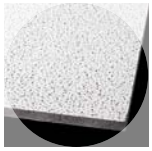
Color Selection

Due to printing limitations, shade may vary from actual product.

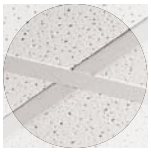
White (WH) | Cream (CR) | Haze (HA) | Camel (CM) | Platinum (PL) | Adobe (AD) | Tech Black (BL)

Items 1728 and 1729 are available in colors and Tech Black.
All other items are available in white only.
Colored ceilings are dye-lotted and should be segregated by dye lot.
Do not mix.

Detail



Fine Fissured Square Lay-in



Fine Fissured Square Lay-in with Prelude 15/16" Exposed Tee grid

FINE FISSURED™

Square Lay-in

medium texture

Recycled Content: Up to 52%

armstrong.com/greengenie

LEED® Credits

Energy	Waste Mgmt	Recycled Content	Local Materials	Renewable Materials	Daylight & Views
✔	✔	✔	✔	✔	✔

Location Dependent

LEED for Schools

Acoustics	Low Emitting or CHPS
✔	✔

5/8" items $$$$$ 3/4" items $$$$$

Visual Selection

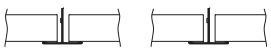
Performance Selection

Dots represent highest level of performance.

Edge Profile	Grid Drawings Cat. pgs. 226-228 or armstrong.com/catdwg	Item No.	Dimensions	UL Classified Acoustics NRC	CAC	Fire Rating	Light Reflect	Sag Resist	Anti-Microbial	Durable	Recycle Program
FINE FISSURED Square Lay-in											
15/16" Square Lay-in	1	1728 1728M	2' x 2' x 5/8" 600 x 600 x 15mm	0.55	33	Class A	0.85 •	HumiGuard+ •	BioBlock+ •	Standard	Yes •
	1	1831 1831M	2' x 2' x 5/8" 600 x 600 x 15mm	0.55	35	Fire Guard	0.85 •	•	•	Standard	•
	1	1729 1729M	2' x 4' x 5/8" 600 x 1200 x 15mm	0.55	35	Class A	0.85 •	•	•	Standard	•
	1	1830 1830M	2' x 4' x 5/8" 600 x 1200 x 15mm	0.55	35	Fire Guard	0.85 •	•	•	Standard	•
	1	1736 1736M	20" x 5' x 5/8" 500 x 1500 x 15mm	0.55	35	Class A	0.85 •	•	•	Standard	•
	1	1737 1737M	2' x 5' x 5/8" 600 x 1500 x 15mm	0.55	35	Class A	0.85 •	•	•	Standard	•
	1	1738 1738M	30" x 5' x 3/4" 750 x 1500 x 19mm	0.55	35	Class A	0.85 •	Standard •	•	Standard	•
FINE FISSURED Square Lay-in High Acoustics											
15/16" Square Lay-in	1	1713	2' x 2' x 3/4"	0.70 •	35	Class A	0.85 •	•	•	Standard	•
	1	1810 1810M	2' x 2' x 3/4" 600 x 600 x 19mm	0.70 •	35	Fire Guard	0.85 •	•	•	Standard	•
	1	1714	2' x 4' x 3/4"	0.70 •	40 •	Class A	0.85 •	•	•	Standard	•
	1	1811 1811M	2' x 4' x 3/4" 600 x 1200 x 19mm	0.70 •	40 •	Fire Guard	0.85 •	•	•	Standard	•

Suspension Systems

15/16"



Prelude®

Prelude XL® Fire Guard

Physical Data

Material
Wet-formed mineral fiber

Surface Finish
Factory-applied latex paint

Fire Performance
ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled) Fire Guard™: A fire resistive ceiling when used in applicable UL assemblies

ASTM E1264 Classification
Type III, Form 2, Pattern C E
Fire Class A

Sag Resistance
HumiGuard® Plus – superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.

VOC/Formaldehyde Emissions
Meets CA Dept. of Health Services Standard Practice for the testing of VOC Emissions and is listed on CHPS High Performance Products Database for Low-Emitting Materials.

Anti Mold/Mildew & Bacteria
BioBlock® Plus contains an anti-microbial treatment and provides guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.

Insulation Value
R Factor – 1.5 (BTU units)
R Factor – 0.26 (Watts units)

30-Year Performance Guarantee & Warranty Information
Details in back of catalog or at armstrong.com/warranty

Application Considerations
Tech Black products should be handled with gloves to prevent marking with fingerprints. Objectionable surface dust may occur with frequent handling of Tech Black products. In these situations, Tech Black products are not recommended for bright open spaces.

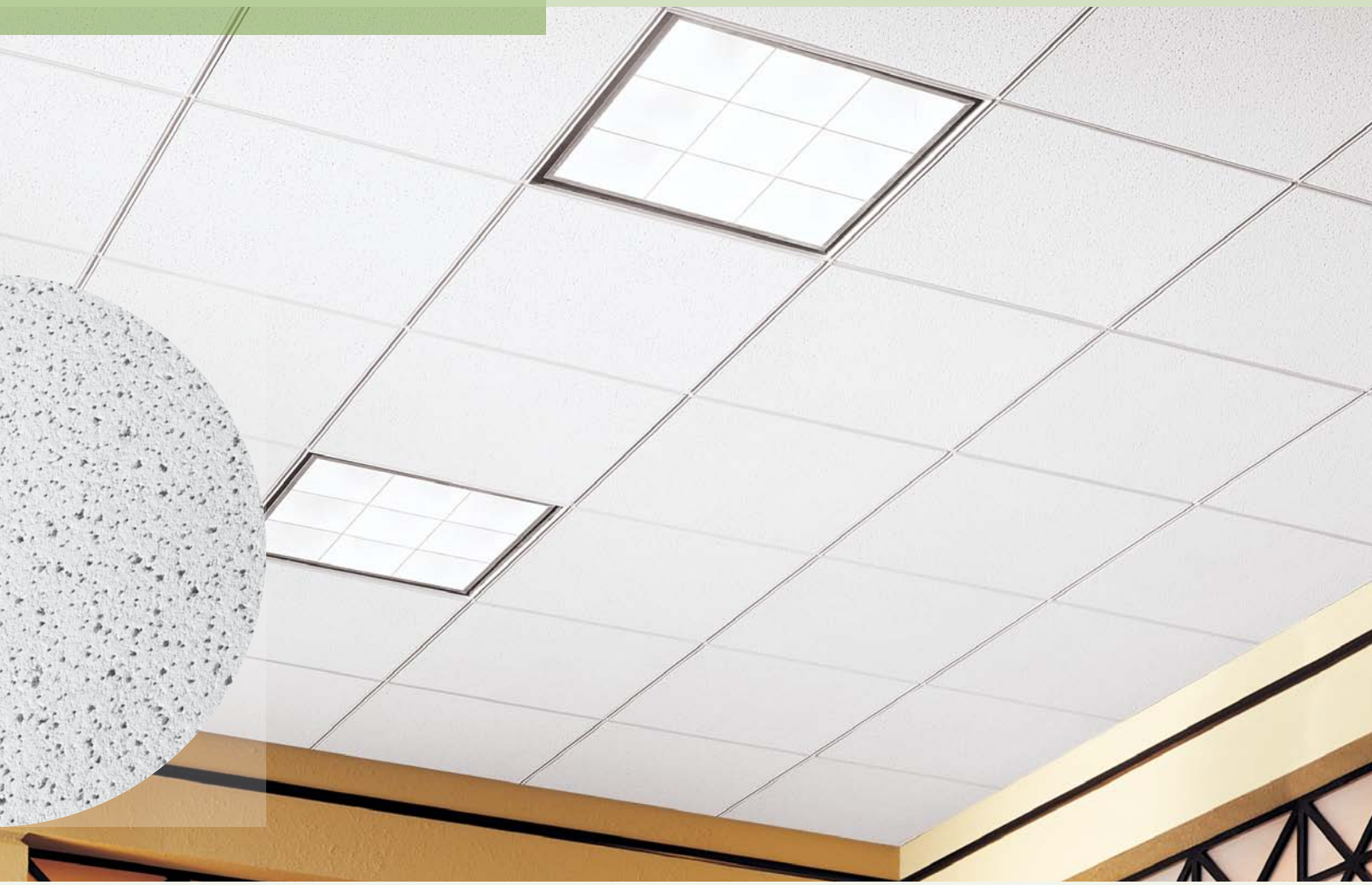
Weight; Square Feet/Carton
1713, 1810 – 1.31 lbs/SF; 48 SF/ctn
1714, 1811 – 1.38 lbs/SF; 64 SF/ctn
1728 – 0.70 lbs/SF; 64 SF/ctn
1729 – 0.70 lbs/SF; 96 SF/ctn
1736, 1737 – 0.93 lbs/SF; 100 SF/ctn
1738 – 0.80 lbs/SF; 75 SF/ctn
1830, 1831 – 1.05 lbs/SF; 64 SF/ctn

FINE FISSURED™

Tegular

medium texture

10-YEAR Availability Items 1732, 1734, 1820, 1821 & 1833



Fine Fissured with Trimlok® 9/16" Screw-Slot grid (Pg. 222)

Key Selection Attributes

- Excellent sound absorption – Products help comply with ANSI S12.60 Classroom Guidelines: Items 1820, 1821, 1824, 1717, 1719
- Non-directional visual reduces installation time and scrap
- 30-Year Limited System Warranty against visible sag, mold/mildew, and bacterial growth

Typical Applications

- Schools
- Healthcare – assists in addressing HIPAA and FGI acoustical requirements (High Acoustics items only)
- Libraries/band rooms
- Conference rooms
- Corridors

Color Selection

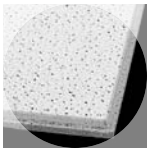
Due to printing limitations, shade may vary from actual product.

White (WH) Cream (CR) Haze (HA) Camel (CM) Platinum (PL) Adobe (AD)

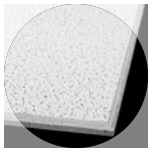
Item 1732 is available in colors. All other items are available in white only. Colored ceilings are dye-lotted and should be segregated by dye lot. Do not mix.

Detail

(Other Suspension Systems compatible. Refer to listing on page 164.)



Fine Fissured Beveled Tegular



Fine Fissured Angled Tegular

Fine Fissured Tegular with Suprafine® 9/16" Exposed Tee grid

FINE FISSURED™

Tegular

medium texture

Recycled Content: Up to 52%

armstrong.com/greengenie

LEED® Credits

Energy	Waste Mgmt	Recycled Content	Local Materials	Renewable Materials	Daylight & Views
✔	✔	✔	✔	✔	✔

Location Dependent

LEED for Schools

Acoustics	Low Emitting or CHPS
✔	✔

5/8" items $$$$$ 3/4" items $$$$$

Visual Selection

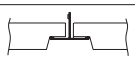
Performance Selection

Dots represent highest level of performance.

Edge Profile	Grid Drawings Cat. pgs. 226-228 or armstrong.com/catdwg	Item No.	Dimensions		UL Classified Acoustics NRC	CAC	Fire Rating	Light Reflect	Sag Resist	Anti-Microbial	Durable	Recycle Program
FINE FISSURED Tegular												
9/16" Beveled Tegular	31-34, 54	**1734** **1734M**	2' x 2' x 5/8" 600 x 600 x 15mm	☐	0.55	35	Class A	0.85 •	HumiGuard+ •	BioBlock+ •	Impact •	Yes •
	30	**1835**	2' x 2' x 5/8"	☐	0.55	35	Fire Guard	0.85 •	•	•	Standard	•
15/16" Angled Tegular	6	**1732**	2' x 2' x 5/8"	☐	0.55	35	Class A	0.85 •	•	•	Standard	•
	6	**1833**	2' x 2' x 5/8"	☐	0.55	35	Fire Guard	0.85 •	•	•	Standard	•
	6	**1733** **1733M**	2' x 4' x 5/8" 600 x 1200 x 15mm	▭	0.55	35	Class A	0.85 •	•	•	Standard	•
	6	**1834**	2' x 4' x 5/8"	▭	0.55	35	Fire Guard	0.85 •	•	•	Standard	•
FINE FISSURED Tegular High Acoustics												
9/16" Beveled Tegular	31	**1719**	2' x 2' x 3/4"	☐	0.70 •	40 •	Class A	0.85 •	•	•	Standard	•
	31	**1821**	2' x 2' x 3/4"	☐	0.70 •	35	Fire Guard	0.85 •	•	•	Standard	•
15/16" Angled Tegular	7	**1717**	2' x 2' x 3/4"	☐	0.70 •	40 •	Class A	0.85 •	•	•	Standard	•
	7	**1820**	2' x 2' x 3/4"	☐	0.70 •	35	Fire Guard	0.85 •	•	•	Standard	•
	7	**1824**	2' x 4' x 3/4"	▭	0.70 •	35	Fire Guard	0.85 •	•	•	Standard	•

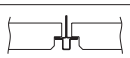
Suspension Systems

15/16"

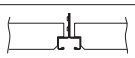


Prelude® XL®
Prelude XL Fire Guard

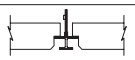
9/16"



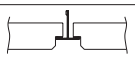
Interlude®



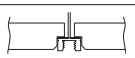
Silhouette® Bolt-Slot



Sonata®



Suprafine®
Suprafine XL Fire Guard



Trimlok® Screw-Slot

Item 1734-CAC 33 on 9/16" Interlude, Sonata, Suprafine

Physical Data

Material
Wet-formed mineral fiber

Surface Finish
Factory-applied latex paint

Fire Performance
ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled) Fire Guard™: A fire resistive ceiling when used in applicable UL assemblies

ASTM E1264 Classification
Type III, Form 2, Pattern C E
Fire Class A

Sag Resistance
HumiGuard® Plus – superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.

VOC/Formaldehyde Emissions
Meets CA Dept. of Health Services Standard Practice for the testing of VOC Emissions and is listed on CHPS High Performance Products Database for Low-Emitting Materials.

Anti Mold/Mildew & Bacteria
BioBlock® Plus contains an anti-microbial treatment and provides guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.

Insulation Value
R Factor – 1.5 (BTU units)
R Factor – 0.26 (Watts units)

30-Year Performance Guarantee & Warranty Information
Details in back of catalog or at armstrong.com/warranty

Weight; Square Feet/Carton
1820, 1821 – 1.31 lbs/SF; 48 SF/ctn
1824 – 1.20 lbs/SF; 64 SF/ctn
1732, 1734 – 0.70 lbs/SF; 64 SF/ctn
1733 – 0.70 lbs/SF; 80 SF/ctn
1833, 1835 – 1.05 lbs/SF; 48 SF/ctn
1834 – 1.05 lbs/SF; 64 SF/ctn
1717, 1719 – 1.25 lbs/SF; 48 SF/ctn

FINE FISSURED™ Open Plan

Square Lay-in & Tegular

medium texture

Recycled Content: 66%

armstrong.com/greengenie

LEED® Credits

Energy	Waste Mgmt	Recycled Content	Local Materials	Renewable Materials	Daylight & Views
☒	☒	☒	☒	☒	☒
			Location Dependent		

LEED for Schools

Acoustics	Low Emitting or CHPS
☒	☒

$$$$$

Fine Fissured Open Plan with Suprafine® 9/16" Exposed Tee grid (Pg. 220); Axiom® Classic Trim (Pg. 236)

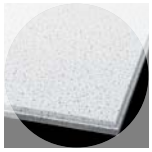
Key Selection Attributes

- Excellent solution in mixed (open plan/ closed plan) office design
- Excellent combination of acoustical performance; Articulation Class (170), NRC (0.75), and CAC (35)
- Non-directional visual reduces installation time and scrap
- 30-Year Limited System Warranty against visible sag (excludes items 1755, 1757, 1759), mold/mildew, and bacterial growth

Typical Applications

- Open plan offices
- Healthcare – assists in addressing HIPAA and FGI acoustical requirements
- Classrooms
- Libraries/media centers
- Lobbies/reception areas
- Computer rooms

Detail



Fine Fissured Open Plan

Color

White (WH)

Visual Selection

Performance Selection

Dots represent highest level of performance.

Edge Profile	Suspension Detail Dwg. Pgs. 226-228	Item No.	Dimensions		UL Classified Acoustics NRC	CAC	AC	Fire Rating	Light Reflect	Sag Resist	Anti-Microbial	Durable	Recycle Program
FINE FISSURED Open Plan													
15/16" Square Lay-in	1	**1754** **1754M**	2' x 2' x 7/8" 600 x 600 x 22mm	☐	0.75 ⊠	35	170 ⊠	Class A	0.86 ⊠	HumiGuard+ ⊠	BioBlock+ ⊠	Standard	Yes ⊠
	1	**1755** **1755M**	2' x 4' x 7/8" 600 x 1200 x 22mm	▭	0.75 ⊠	35	170 ⊠	Class A	0.86 ⊠	Standard	⊠	Standard	⊠
9/16" Beveled Tegular	31-34, 54	**1758** **1758M**	2' x 2' x 7/8" 600 x 600 x 22mm	☐	0.75 ⊠	35	170 ⊠	Class A	0.86 ⊠	⊠	⊠	Standard	⊠
	31-34, 54	**1759** **1759M**	2' x 4' x 7/8" 600 x 1200 x 22mm	▭	0.75 ⊠	35	170 ⊠	Class A	0.86 ⊠	Standard	⊠	Standard	⊠
15/16" Angled Tegular	7	**1756** **1756M**	2' x 2' x 7/8" 600 x 600 x 22mm	☐	0.75 ⊠	35	170 ⊠	Class A	0.86 ⊠	⊠	⊠	Standard	⊠
	7	**1757** **1757M**	2' x 4' x 7/8" 600 x 1200 x 22mm	▭	0.75 ⊠	35	170 ⊠	Class A	0.86 ⊠	Standard	⊠	Standard	⊠

Suspension Systems

15/16" Prelude®

9/16" Interlude® | Silhouette® Bolt-Slot | Sonata® | Suprafine® | Trimlok® Screw-Slot

Item 1758-CAC 33 on 9/16" Interlude, Sonata, Suprafine

Physical Data

Material
Wet-formed mineral fiber

Surface Finish
Factory-applied latex paint

Fire Performance
ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled)

ASTM E1264 Classification
Type III, Form 1, Pattern C E
Fire Class A

Sag Resistance
HumiGuard® Plus – superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.

VOC/Formaldehyde Emissions
Meets CA Dept. of Health Services Standard Practice for the testing of VOC Emissions and is listed on CHPS High Performance Products Database for Low-Emitting Materials.

Anti Mold/Mildew & Bacteria
BioBlock® Plus contains an anti-microbial treatment and provides guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.

Insulation Value
R Factor – 2.3 (BTU units)
R Factor – 0.40 (Watts units)

30-Year Performance Guarantee & Warranty Information
See warranty details in the back of this catalog

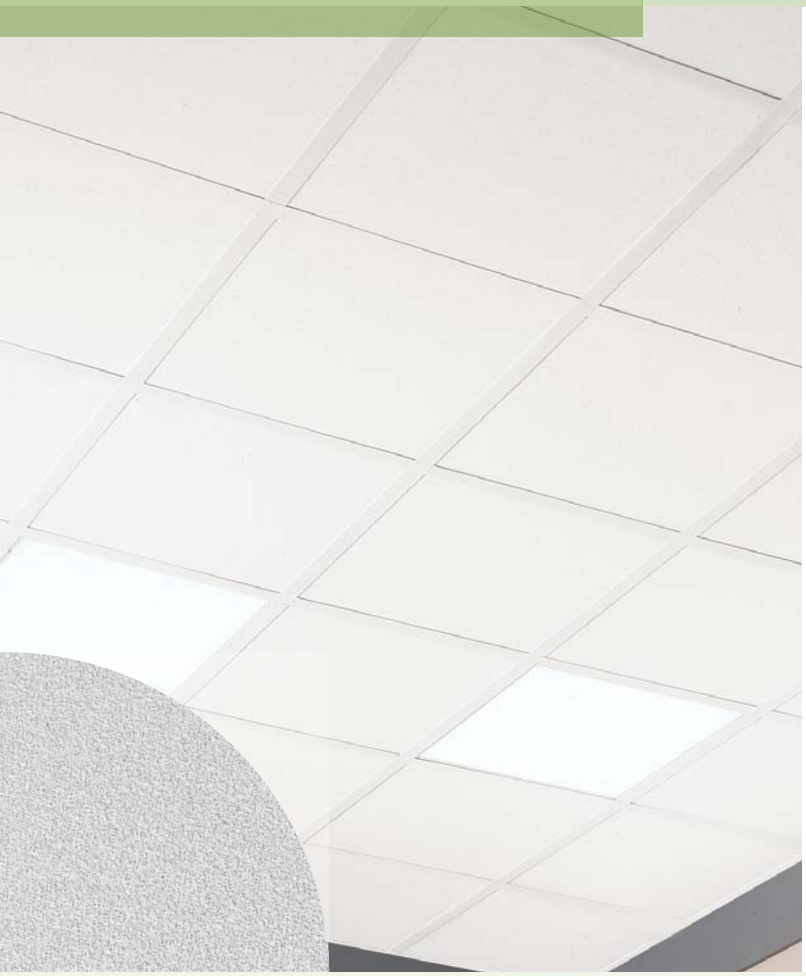
Weight; Square Feet/Carton
1754, 1756, 1758 – 1.08 lbs/SF; 40 SF/ctn
1755, 1757, 1759 – 1.08 lbs/SF; 48 SF/ctn

Clean Room™ FL & VL
Clean Room OPTIMA®, Clean Room ULTIMA®

Square Lay-in, Tegular

smooth texture

10-YEAR Availability Items 1715, 1716, 1720, 1721



Clean Room Ultima with Clean Room 15/16" grid (Pg. 210)

Clean Room Optima with Prelude® 15/16" Exposed Tee grid (Pg. 215)

Clean Room FL with Clean Room 1-1/2" Exposed Tee grid (Pg. 210)

Key Selection Attributes

- Clean Rooms up to ISO Class 5 (Class 100)
- Meets USDA/FSIS guidelines for use in food processing areas (excludes items 869, 871)
- Durable – Washable, Scrubbable, Soil-resistant
- Non-directional visual reduces installation time and scrap
- 30-Year Limited System Warranty against visible sag, mold/mildew, and bacterial growth

Clean Room Optima and Ultima Additional Benefits

- Exceeds FGI Guidelines for acoustics and cleanability in general healthcare spaces
- Long-lasting water-repellency

Typical Applications

Clean Room FL, Clean Room VL, Clean Room Ultima

Clean Rooms
Kitchens/food preparation areas
Laboratories
Healthcare

- Patient Rooms
- Treatment Rooms
- Semi-restricted surgical areas
- Emergency rooms

Clean Room Optima

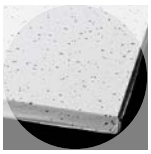
Clean Rooms
Kitchens/food preparation areas
Laboratories
Healthcare

- Patient rooms (walls-to-deck)
- Treatment rooms (walls-to-deck)
- Emergency rooms (walls-to-deck)
- Semi-restricted surgical areas (walls-to-deck)
- MRI rooms

VL (Perforated)

- Lavatories/restrooms

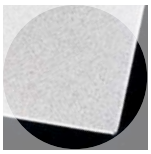
Detail (Other Suspension Systems compatible. Refer to listing on pages 151-152.)



Clean Room FL

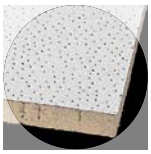
Clean Room VL

Clean Room Optima Square Lay-in



Clean Room Ultima Square Lay-in

Clean Room FL with Clean Room 1-1/2" Exposed Tee grid



VL

Color

White (WH) (Clean Room Optima, Clean Room Ultima, Clean Room VL & VL)

White with Gray Spatter (Clean Room FL)

Clean Room™ OPTIMA® Clean Room ULTIMA®

Square Lay-in, Tegular

smooth texture

Recycled Content: Up to 80%

armstrong.com/greengenie

LEED® Credits

Energy	Waste Mgmt	Recycled Content	Local Materials	Renewable Materials	Daylight & Views
✔	✔	✔	✔ Location Dependent		✔

LEED for Schools

Acoustics	Low Emitting or CHPS
✔	✔

$$$$$

Visual Selection

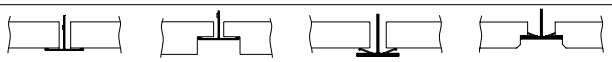
Performance Selection

Dots represent highest level of performance.

Edge Profile	Suspension Detail Dwg. Pgs. 226-228	Item No.	Dimensions		UL Classified Acoustics NRC	CAC	AC	Fire Rating	Light Reflect	Sag Resist	Anti-Microbial	Durable							Recycle Program
Clean Room OPTIMA (see Health Zone™ Optima, Items 3114, 3115, 3214, 3215, Pgs. 113-114)																			
15/16" Square Lay-in	2	**3114**	2' x 2' x 1"		0.95 ●	N/A	190 ●	Class A	0.86 ●	HumiGuard+ ●	Inherent ●	Wash ●	Scrub ●	Water Repel ●	Impact ●	Scratch ●	Soil ●	Yes ●
	12, 2	**3115**	2' x 4' x 1"		0.95 ●	N/A	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	●
	12, 2	**3314**	2' x 2' x 1-1/2"		0.95 ●	29	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	–
	12, 2	**3315**	2' x 4' x 1-1/2"		0.95 ●	29	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	–
15/16" Square Tegular	12, 2	**3214**	2' x 2' x 1"		0.95 ●	N/A	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	●
	12, 2	**3215**	2' x 4' x 1"		0.95 ●	N/A	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	●
	12, 2	**3316**	2' x 2' x 1-1/2"		0.95 ●	29	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	–
	12, 2	**3317**	2' x 4' x 1-1/2"		0.95 ●	29	190 ●	Class A	0.86 ●	●	●	●	●	●	●	●	●	–
Clean Room ULTIMA (see Health Zone Ultima, Items 1935 and 1937, Pg. 173)																			
15/16" Square Lay-in	2	**1935**	2' x 2' x 3/4"		0.70 ●	35	N/A	Class A	0.86 ●	HumiGuard+ ●	Inherent ●	Wash ●	Scrub ●	Water Repell. ●	Impact ●	Scratch ●	Soil ●	Yes ●
15/16" Beveled Tegular	12, 2A	**1937**	2' x 2' x 3/4"		0.70 ●	35	N/A	Class A	0.86 ●	●	●	●	●	●	●	●	●	●

Suspension Systems

15/16"



Prelude®
Prelude Plus
AL Prelude Plus XL®

Clean Room

Physical Data

Material
3114, 3115, 3214, 3215 – Fiberglass with DuraBrite® acoustically transparent membrane
1935, 1937 – Wet formed mineral fiber with DuraBrite acoustically transparent water-repellent membrane

Surface Finish
DuraBrite with factory-applied latex paint

Fire Performance
ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled)

ASTM E1264 Classification
3114, 3115, 3214, 3215, 3314, 3315, 3316, 3317 – Type XII, Form 2, Pattern E
1935, 1937 – Type IV, Form 2, Pattern E
Fire Class A

Sag Resistance
HumiGuard® Plus – superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.

VOC/Formaldehyde Emissions
Meets CA Dept. of Health Services Standard Practice for the testing of VOC Emissions and is listed on CHPS High Performance Products Database for Low-Emitting Materials.

Anti Mold/Mildew & Bacteria
3114, 3115, 3214, 3215, 3314, 3315, 3316, 3317 – Fiberglass substrate is inherently resistant to the growth of mold, mildew, and bacteria.

1935, 1937 – BioBlock® Plus contains an anti-microbial treatment and provides guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.

Acoustical Details
3314, 3315, 3316, and 3317 have CAC backing. Products with CAC backing are not UL Classified for acoustics. Contact TechLine for independant laboratory acoustic testing.

Insulation Value
3114, 3115, 3214, 3215, 3314, 3315, 3316, 3317 –
R Factor – 4.0 (BTU units)
R Factor – 0.70 (Watts units)
1935, 1937 –
R Factor – 2.2 (BTU units)
R Factor – 0.39 (Watts units)

30-Year Performance Guarantee & Warranty Information
See warranty details at armstrong.com/warranty

Application Considerations

Clean Room Optima (Health Zone Optima)
For Clean Room installations with Clean Room Optima, use full-size panels with Clean Room grid.

Clean Room Ultima (Health Zone Ultima)
For Clean Room installations with Clean Room Ultima, use full-size panels (items 1935 and 1937) with Clean Room grid. Clean Room Ultima has been tested to withstand 500 wash and scrub cycles.

Cleaning Recommendations
To clean panel, use a clean, white cloth with water or a mild detergent and wipe surface. To disinfect panel, lightly spray surface and wipe clean with a clean, white cloth. Acceptable colorless disinfectants include:
- Sodium hypochlorite
- Isopropyl alcohol
- Hydrogen peroxide
- Quaternary ammonium

Weight; Square Feet/Carton
3114, 3115, 3214, 3215 – 0.45 lbs/SF; 96 SF/ctn
1935, 1937 – 1.08 lbs/SF; 48 SF/ctn
3314, 3315, 3316, 3317 – 0.78 lbs/SF; 64 SF/ctn

Note: For assistance on proper Clean Room installation, contact TechLine at 1 877 ARMSTRONG. For Clean Room installations, use Clean Room Optima or Clean Room Ultima only with Armstrong Clean Room Grid Systems.

Recycled Content: Up to 70% armstrong.com/greengenie

LEED® Credits

Energy	Waste Mgmt	Recycled Content	Local Materials	Renewable Materials	Daylight & Views
		✔	✔	✔	

Location Dependent

LEED for Schools

Acoustics	Low Emitting or CHPS
	✔

$$$$$

Clean Room™ FL/ Clean Room VL & VL

Square Lay-in, Tegular

smooth texture

Visual Selection

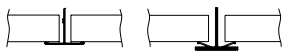
Performance Selection

Dots represent highest level of performance.

Edge Profile	Suspension Detail Dwg. Pgs. 226-228	Item No.	Dimensions	UL Classified Acoustics NRC	CAC	Fire Rating	Light Reflect	Sag Resist	Anti-Microbial	Durable: Wash	Scrub	Water Repel	Soil	Recycle Program
Clean Room FL Field Unit – Class 5 (Class 100)														
15/16" or 1-1/2" Square Lay-in	1,2	**1715** **1715M**	2' x 2' x 3/4" 600 x 600 x 19mm	0.55	35	Class A	0.79	HumiGuard+	BioBlock+					–
								•	•	•	•	•	•	
	1,2	**1716** 1716M	2' x 4' x 3/4" 600 x 1200 x 19mm	0.55	35	Class A	0.79							–
								•	•	•	•	•	•	
Clean Room FL Border Unit – Class 5 (Class 100)														
15/16" or 1-1/2" Square Lay-in	1,2	**1720** **1720M**	2' x 2' x 5/8" 600 x 600 x 15mm	N/A	35	Class A	0.79							–
								•	•	•	•	•	•	
	1,2	**1721** **1721M**	2' x 4' x 5/8" 600 x 1200 x 15mm	N/A	35	Class A	0.79							–
								•	•	•	•	•	•	
Clean Room VL Unperforated – Class 5 (Class 100)														
15/16" or 1-1/2" Square Lay-in	1	**868** **868M**	2' x 2' x 5/8" 600 x 600 x 15mm	N/A	40 •	Fire Guard	0.80							–
								•	•	•	•	•	•	
	1	**870** **870M**	2' x 4' x 5/8" 600 x 1200 x 15mm	N/A	40 •	Fire Guard	0.80							–
								•	•	•	•	•	•	
VL Perforated														
15/16" or 1-1/2" Square Lay-in	1	**869** **869M**	2' x 2' x 5/8" 600 x 600 x 15mm	0.55	35	Fire Guard	0.78							–
								•	•	•	•	•	•	
	1	**871** **871M**	2' x 4' x 5/8" 600 x 1200 x 15mm	0.55	35	Fire Guard	0.78							–
								•	•	•	•	•	•	

Suspension Systems

15/16"



Prelude®
Prelude XL®
Fire Guard

Clean Room

1-1/2"

Clean Room

Physical Data

Material
Wet-formed mineral fiber

Surface Finish
1715, 1716, 1720, 1721 – Soil-resistant polyester film
868, 870, 869, 871 – Vinyl-faced membrane

Fire Performance
ASTM E84 and CAN/ULC S102 surface burning characteristics. Flame Spread Index 25 or less. Smoke Developed Index 50 or less. (UL labeled)
Fire Guard™: A fire resistive ceiling when used in applicable UL assemblies

ASTM E1264 Classification
1715, 1716, 1720, 1721 – Type IV, Form 2, Pattern G H
868, 870, – Type IV, Form 2, Pattern E
869, 871 – Type IV, Form 2, Pattern C E
Fire Class A

Sag Resistance
HumiGuard® Plus – superior resistance to sagging in high humidity conditions up to, but not including, standing water and outdoor applications.

VOC/Formaldehyde Emissions
Meets CA Dept. of Health Services Standard Practice for the testing of VOC Emissions and is listed on CHPS High Performance Products Database for Low-Emitting Materials.

Anti Mold/Mildew & Bacteria
BioBlock® Plus contains an anti-microbial treatment and provides guaranteed resistance against growth of mold/mildew and Gram-positive and Gram-negative odor/stain-causing bacteria for 30 years.

Insulation Value
R Factor – 1.5 (BTU units)
R Factor – 0.26 (Watts units)

30-Year Performance Guarantee & Warranty Information
See warranty details at armstrong.com/warranty

Application Considerations

Clean Room FL
If acoustical absorption is required, specify a combination of field and border units – field units for use as full-size panels only; border units for use where panels must be cut on the job (borders, sprinkler head penetrations, etc.).

VL Perforated
869, 871 – VL Perforated is not intended for Clean Room and kitchen/food preparation applications. Use unperforated product – 868, 870.

Clean Room VL
Clean Room VL has been tested to withstand 10,000 scrub cycles.
Clean Room VL is not appropriate for applications where germicidal lamps are being used.

Weight; Square Feet/Carton
1715 – 1.02 lbs/SF; 48 SF/ctn
1716 – 1.02 lbs/SF; 64 SF/ctn
1720 – 1.04 lbs/SF; 48 SF/ctn
1721 – 1.17 lbs/SF; 64 SF/ctn
868, 869 – 1.10 lbs/SF; 48 SF/ctn
870, 871 – 1.11 lbs/SF; 64 SF/ctn

Note: For assistance on proper Clean Room installation, contact TechLine at 1 877 ARMSTRONG. For Clean Room installations, use Clean Room FL or Clean Room VL only with Armstrong Clean Room Grid Systems.

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient stair accessories.
3. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE (WB1)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johnsonite; A Tarkett Company.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style: Style B, Cove.

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As selected by Architect from full range of industry colors.

2.2 THERMOPLASTIC-RUBBER BASE (WB2)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Johnsonite; A Tarkett Company.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:

a. Style D, Sculptured: Provide in areas indicated.

1) Profile: Millwork, Diplomat.

C. Thickness: 0.375 inch.

D. Height: 4-1/2 inches.

E. Lengths: Cut lengths 96 inches long.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As selected by Architect from full range of industry colors.

2.3 RUBBER STAIR ACCESSORIES

A. Resilient Stair Treads:

1. Manufacturers: Subject to compliance with requirements, provide products by Johnsonite.

Resilient Stair Treads Standard: ASTM F 2169.

2. Material Requirement: Type TS (rubber, vulcanized thermoset).
3. Surface Design:

a. Class 2, Pattern: To be determined.

4. Manufacturing Method: Group 1, tread with embedded abrasive strips and Group 2, tread with contrasting color for the visually impaired.

B. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.

C. Nosing Height: 1-1/2 inches.

D. Thickness: 1/4 inch and tapered to back edge.

E. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.

F. Rubber Risers: Smooth, flat, risers, 1/8 inch thick integral with tread unit.

G. Riser and Tread Fillers: Provide Johnsonite Subfloor Leveling System components to fill the riser space below the existing nosing to comply with details. Also use Subfloor Leveling System to level the top tread to surrounding floor surface.

H. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 RUBBER OR VINYL MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Roppe Corporation, USA.
2. VPI, LLC, Floor Products Division.
3. Johnsonite.

B. Profile and Dimensions: As indicated.

C. Locations: Provide molding accessories in areas indicated.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Rubber Floor Adhesives: 60 g/L.

D. Epoxy Adhesives: Two-part epoxy compound recommended by resilient tread manufacturer to adhere rubber treads and risers to substrates.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Rubber Floor Adhesives: 60 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Verify that testing has been performed by others. Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Verify that testing has been performed by others. Proceed with installation only after substrates pass testing according to manufacturer's written recommendations.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

    a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
2. Tightly adhere to substrates throughout length of each piece.
3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

Johnsonite®

Resilient Rubber Wall Base – Traditional with Toe profile

1. PROPRIETARY PRODUCT/MANUFACTURER:

Proprietary Product: Resilient Vinyl Wall Base (with Toe) .

MANUFACTURER

Johnsonite, Inc.	Phone	(800) 899-8916
16910 Munn Road		(440) 543-8916
Chagrin Falls, Ohio 44023	Tech:	Ext 297
Web: www.johnsonite.com	Samples:	Ext 299
E-mail: info@johnsonite.com	Fax:	(440) 543-8920

Proprietary Product Description:

Construction: Johnsonite wall base is manufactured from a proprietary thermoplastic rubber formulation designed specifically to meet the performance and dimensional requirements of ASTM F-1861, Type TP, Group 1 (solid) Standard Specification for Resilient Wall Base.

StyleResilient\Topset (DC-XX Height - length): . .45" (11.1mm) overall thickness.

Color Sample:

Product Application:

Physical Characteristics:

1/8" (3.18mm) profile thickness
2 1/2" (6.35cm), 4" (10.6cm), and 6" (15.24cm) overall heights
4' (1.22m) straight lengths and 100' (30.48m) coiled lengths
Pieces or Feet/carton: 30 straight lengths or 100ft coiled
Outside corners (DC XX Height – LOC) with 4" (10.16cm) returns available

2. PRODUCT PERFORMANCE AND TECHNICAL DATA:

Hardness: ASTM D 2240 Rubber – Rubber-85 Shore A; Vinyl 90 Shore A
Flexibility: Will not crack, break or show any signs of fatigue when bent around a ¼" (6.4mm) diameter cylinder.
Fire Resistance: ASTM E 648/NFPA 253 (Critical Radiant Flux) – Class 1
ASTM E 84/NFPA 255: Flame/Smoke- Class B / less than 450 Smoke.
Meets or exceeds the performance requirements for resistance to heat/light aging, chemicals, and dimensional stability when tested to the methods, as described, in ASTM F-1861 Standard Specification for Resilient Wall Base.

3. INSTALLATION:

The installation of Johnsonite Wall Base should not begin until the work of all other trades has been completed, especially overhead trades. Areas to receive wall base shall be clean, fully enclosed, weathertight, and maintained at a uniform temperature of at least 65˚F for 24 hours before, during, and after the installation is completed. The wall base and adhesives shall be conditioned in the same manner. Floors and walls shall be clean, dry, free of dust, all paints, wallpaper, and all other foreign material, which may affect proper adhesive bonding. Wall base may be installed on interior plaster, gypsum wallboard, concrete, masonry, mineral-reinforced cement board or similar porous surfaces. Wall base shall not be installed on surfaces that will be exposed to drastic temperature changes or moisture. Cut the wall base to finished length and miter cut the ends for inside and outside corners.

ADHESIVES:

Porous Surfaces
- **960 Acrylic Cove Base Adhesive**
  - Application: 1/8" square notch trowel
  - Coverage: Approximately 250 linear feet of 4" Wall Base

NonPorous Surfaces
- **945 Contact Bond Adhesive**
  - Application: Brush or roller
  - Coverage: approximately 360 sq ft/gallon
- **960 Acrylic Cove Base Adhesive**
  - Application:1/8" square notch trowel.
  - Coverage: in linear ft/gal – 250 to 300

Installation Manual: Refer to Johnsonite Rubber and Vinyl Wall Base Installation Instructions for complete installation details

4. AVAILABILITY AND COST:

Available through authorized Johnsonite distributors nationwide.

5. WARRANTY:

Limited 1 year warranty. For complete details, contact Johnsonite or an authorized Johnsonite distributor.

6. MAINTENANCE:

Refer to Johnsonite Rubber and Vinyl Wall Base Maintenance Instructions for complete maintenance details.

7. TECHNICAL SERVICES:

Samples: Submittal samples for verification and approval available upon request from Johnsonite. Samples shall be submitted in compliance with the requirements of the Contract Documents. Accepted and approved samples shall constitute the standard materials which represent materials installed on the project.
For current Installation and Maintenance Instructions, Product Specifications, and other technical data, visit us on the web at www.johnsonite.com or contact Johnsonite at 1-800-899-8916.

Johnsonite®

Millwork® Resilient Wall Base – Diplomat® profile

1. PROPRIETARY PRODUCT/MANUFACTURER:

Proprietary Product: Millwork® Resilient Wall Base profiles replicate the look of finely milled wood.

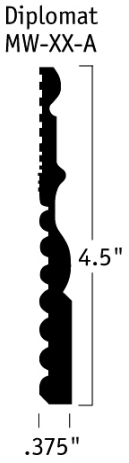
MANUFACTURER:

Johnsonite, Inc.	Phone	(800) 899-8916
16910 Munn Road		(440) 543-8916
Chagrin Falls, Ohio 44023	Tech:	Ext 297
Web: www.johnsonite.com	Samples:	Ext 299
E-mail: info@johnsonite.com	Fax:	(440) 543-8920

PROPRIETARY PRODUCT DESCRIPTION:

Construction: Johnsonite Millwork® Resilient Wall Base is manufactured from a proprietary thermoplastic rubber formulation designed specifically to meet the performance and dimensional requirements of ASTM F-1861 Standard Specification for Resilient Wall Base, Type TP, and Group 1.

Style: Diplomat® (MW-XX-A): 3/8" (9.52mm) thick by 4-1/2" (11.43cm).



Color Sample:

Product Application:

Physical Characteristics:

Length: 8 ft (2.37m)
Pieces/carton: 6 pcs
Weight/carton: 44 lbs

2. PRODUCT PERFORMANCE AND TECHNICAL DATA:

Hardness: ASTM D 2240 – 85 Shore A

Flexibility: Will not crack, break or show any signs of fatigue when bent around a ¼" (6.4mm) diameter cylinder.

Fire Resistance: ASTM E 648/NFPA 253 (Critical Radiant Flux) – Class 1
ASTM E 84/NFPA 255: Flame/Smoke- Class A / less than 450 Smoke.

Chemical Resistance: ASTMF F 925, Passed – 5% Acetic acid, 70% Isopropyl alcohol, White mineral oil (medicinal grade), Sodium Hydroxide solution (5% NaOH), Hydrochloric acid solution (5% HCl), Sulfuric acid solution (5% H_2SO_4), House ammonia solution (5% NH_4OH), Household bleach (5.25% NaOCl), Olive oil (light), Kerosene (K1) and Unleaded gasoline (regular grade).

Meets or exceeds the performance requirements for resistance to heat/light aging, chemicals, and dimensional stability when tested to the methods, as described, in ASTM F-1861 Standard Specification for Resilient Wall Base.

3. INSTALLATION:

The installation of Johnsonite Millwork® Resilient Wall Base should not begin until the work of all other trades has been completed, especially overhead trades. Areas to receive wall base shall be clean, fully enclosed, weathertight, and maintained at a uniform temperature of at least 65˚F for 24 hours before, during, and after the installation is completed. The wall base and adhesives shall be conditioned in the same manner. Floors and walls shall be clean, dry, free of dust, all paints, wallpaper, and all other foreign material, which may affect proper adhesive bonding. Wall base may be installed on interior plaster, gypsum wallboard, concrete, masonry, mineral-reinforced cement board or similar porous surfaces. Wall base shall not be installed on surfaces that will be exposed to drastic temperature changes or moisture. Cut the wall base to finished length and miter cut the ends for inside and outside corners.

ADHESIVES:

Nonporous Substrates:
- **945 Contact Bond Adhesive**
  - Application: Brush or roller
  - Coverage: Approximately 360 sq. ft/gallon

Porous Substrates:
- **960 Acrylic Cove Base Adhesive**
  - Application**:** 1/8" square notch trowel.
  - Coverage: Approximate coverage in linear ft/gal – 222-267

Installation Manual: Refer to Johnsonite Millwork® Installation Instructions for complete installation details

4. AVAILABILITY AND COST:

Available through authorized Johnsonite distributors nationwide.

5. WARRANTY:

Limited 1 year warranty. For complete details, contact Johnsonite or an authorized Johnsonite distributor.

6. MAINTENANCE:

Refer to Johnsonite Rubber and Vinyl Wall Base Maintenance Instructions for complete maintenance details.

7. TECHNICAL SERVICES:

Samples: Submittal samples for verification and approval available upon request from Johnsonite. Samples shall be submitted in compliance with the requirements of the Contract Documents. Accepted and approved samples shall constitute the standard materials which represent materials installed on the project.

For current Installation and Maintenance Instructions, Product Specifications, and other technical data, visit us on the web at www.johnsonite.com or contact Johnsonite at 1-800-899-8916.

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE **(LVT)**

A. Products: Subject to compliance with requirements, provide the following:
1. Armstrong World Industries, Inc; Natural Creations Earthcuts.

B. Tile Standard:

1. Class: Class I, vinyl tile.
2. Type: B, embossed surface.

C. Thickness: 0.125 inch.

D. Size: 18 by 18 inches.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. Adhesives shall comply with the following limits for VOC content:

a. Vinyl Composition Tile Adhesives: 50 g/L or less.
b. Rubber Floor Adhesives: 60 g/L or less.

2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Resilient Rubber Athletic Flooring.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, application instructions and general recommendations.

B. Shop Drawing: Provide drawing indicating floor termination details.

C. Samples for Selection: Submit two samples, 6 x 6 inch in size illustrating color and texture for each floor material for each color specified.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Manufacturers maintenance instructions.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer approved Installer, who has technical qualifications, currently certified in writing, and facilities to install specified systems.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 55 and 80 deg F.

B. Store rolls upright.

1.5 PROJECT CONDITIONS

A. The General Contractor or Construction Manager shall be responsible for ensuring all site conditions meet the requirements of the rubber athletic flooring Manufacturer.

B. Maintain a stable room and subfloor temperature for a period of 48 hours prior, during and 48 hours after installation. Recommended range: 65oF to 86oF (18oC to 30oC).

C. Moisture vapor emission content of the concrete slab must not exceed the tolerance of the adhesive used, when tested using the anhydrous calcium chloride test as per ASTM F1869 and/or using the in-situ probes test as per ASTM F2170.

D. Installation of rubber athletic flooring will not commence unless all other trades in the building are completed. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of rubber athletic flooring.

1.6 WARRANTY

A. Provide current standard warranty, as published by the Manufacturer.

B. The rubber athletic flooring is warranted to be free from manufacturing defects for a period of three (3) years from the date of shipment from the Manufacturer.

PART 2 - PRODUCTS **(RAF)**

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Provide the following:

1. Mondo: Sport Impact.

2.2 MATERIALS

A. Performance Layer:

1. Solid 3mm homogenous rubber wear layer engineered to withstand heavy abuse from skate blades, and strength and condition areas.
2. Non-porous surface requires no coating or finishes.
3. Elimination of odors and hygiene issues.

B. Impact Layer:

1. Provide protection against heavy impact.
2. Glued down installation eliminates change of bacteria or mod growth.

C. Comfort and Safety:

1. Class 1 fire code rating.
2. Antibacterial and antimicrobial throughout which minimizes the risk of staph infections (MRSA).
3. Outstanding slip resistance, ADA compliant as per ASTM D2047.

D. Thickness: 3 mm wear layer (10 mm overall thickness).

E. Texture: Sealskin.

F. Material available in sheets: 6 foot wide and 19 to 33 feet long.

2.3 ACCESSORIES

A. Subfloor Filler: Patching or leveling compound to be supplied and/or recommended/approved by rubber athletic flooring Manufacturer.

B. Adhesives: Provide adhesive certified by rubber athletic flooring manufacturer: PU 105 polyurethane adhesive. Refer to current guidelines on product mixing and use, as published by the Manufacturer. EP 55 epoxy adhesive may be used in areas that have not been specified for use with Mondo Everlay, and that will not be subject to impacts or dynamic loads such as bleachers.

C. Base: Refer to Division 09 Section “Resilient Base and Accessories for wall base used with floor materials.

D. Transitions: Refer to Division 09 Section “Resilient Base and Accessories for transitions to adjacent floor materials.

2.4 COLORS

A. Color as selected by Architect from manufacturer’s full line of color options.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.

B. Concrete Subfloors: Verify that concrete slabs cured a minimum 60 days and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
3. Moisture and alkalinity tests must be preformed. Moisture content must not exceed the capacity of the specified adhesive (verify using the anhydrous calcium chloride test as per ASTM F1869 and/or in-situ probes test as per ASTM F2170) and pH level should be in the range of 7 to 8.5.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove grease, oil, and other penetrating contaminates. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.

B. Moving cracks and joints shall be thoroughly routed and vacuumed clean, then filled with approved material.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. Follow all manufacturer’s installation instructions.

3.4 CLEANING AND PROTECTING

A. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.

B. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION 096566

SPORT IMPACT

For the most demanding areas, Sport Impact is the premium weight and skate resistant rubber flooring. It is the leading choice for weight/skate applications.

PERFORMANCE LAYER

- Solid 3mm homogenous rubber wear layer engineered to withstand heavy abuse from skate blades, and strength and condition areas
- Non-porous surface requires no coating or finishes
- Elimination of odors and hygiene issues

IMPACT LAYER

- Provides protection against heavy impact
- Glued down installation eliminates chance of bacteria or mold growth

COMFORT AND SAFETY

- Class 1 fire code rating
- Antibacterial and antimicrobial throughout which minimizes the risk of staph infections (MRSA)
- Outstanding slip resistance, ADA compliant as per ASTM D2047

DURABILITY AND LIFE CYCLE COST

- Ease of maintenance
- Engineered to withstand static loads such as heavy weights and cardio equipment
- 10+ year life expectancy
- 100% recyclable

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Tufted carpet.

1.3 ACTION SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

1.9 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET (CPT1)

A. Products: Subject to compliance with requirements, provide the following:

1. Patcraft; Buy In.
2. Color/Pattern: Solitaire.

B. Fiber Type: Solution Q Nylon.

C. Dye Method: 100% Solution dyed.

D. Pile Characteristic: Pattern-loop pile.

E. Density: 5236.

F. Finished Pile Thickness: 0.165 inch.

G. Stitches: 10 per inch.

H. Gage: 1/10.

I. Tufted Pile Weight: 24 oz./sq. yd..

J. Pattern Repeat: 26/32”W x 2-11/32”L.

K. Primary Backing: Woven synthetic.

L. Secondary Backing: ClassicBac.

M. Width: 12 feet.

N. Performance Characteristics: As follows:

1. Flooring Radiant Panel: ASTM E648 Direct Glue Down Mode – Class 1
2. NBS Smoke Chamber: ASTM E662 Flaming Mode – 450 or less
3. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
4. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.2 TUFTED CARPET (CPT2)

A. Products: Subject to compliance with requirements, provide the following:

1. Shaw Hospitality; After Hours.
2. Color/Pattern: Familiar Places.

B. Fiber Type: Eco Solution Q nylon.

C. Dye Method: 100% Solution dyed.

D. Pile Characteristic: Mulit-level pattern cut-loop pile.

E. Density: 5938.

F. Finished Pile Thickness: 0.194 inch.

G. Stitches: 11 per inch.

H. Gage: 1/10.

I. Tufted Pile Weight: 32 oz./sq. yd..

A. Primary Backing: Woven synthetic.

B. Secondary Backing: Manufacturer's standard material.

C. Width: 12 feet.

D. Performance Characteristics: As follows:

1. Flooring Radiant Panel: ASTM E648 Direct Glue Down Mode – Class 1
2. NBS Smoke Chamber: ASTM E662 Flaming Mode – 450 or less
3. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.

4. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.3 TUFTED CARPET (CPT3)

A. Products: Subject to compliance with requirements, provide the following:

1. Masland Hospitality; Voluta.
2. Color/Pattern: Esquiline Hill.

B. Fiber Type: Antron Legacy® Nylon.

C. Dye Method: Skein dyed.

D. Pile Characteristic: Tip sheared loop pile.

E. Pile Thickness: 0.384, .0256, 0.128 inches.

F. Gage: 1/12.

G. Tufted Pile Weight: 32 oz./sq. yd..

H. Primary Backing: Woven polypropylene.

I. Secondary Backing: Woven polypropylene with Unitary.

J. Width: 12 feet.

K. Performance Characteristics: As follows:

1. Flooring Radiant Panel: ASTM E648 Direct Glue Down Mode – Class 1
2. NBS Smoke Chamber: ASTM E662 Flaming Mode – 450 or less
3. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
4. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.4 TUFTED CARPET (CPT4)

A. Products: Subject to compliance with requirements, provide the following:

1. Masland Hospitality; Keystone.

2. Color: To be determined.

B. Fiber Type: Antron Legacy® Nylon.

C. Dye Method: Beck dyed.

D. Pile Characteristic: Cut pile.

E. Pile Thickness: 0.343 inches.

F. Gage: 1/10.

G. Tufted Pile Weight: 32 oz./sq. yd..

H. Primary Backing: Woven polypropylene.

I. Secondary Backing: Woven polypropylene with Unitary.

J. Width: 12 feet.

K. Performance Characteristics: As follows:

1. Flooring Radiant Panel: ASTM E648 Direct Glue Down Mode – Class 1
2. NBS Smoke Chamber: ASTM E662 Flaming Mode – 450 or less
3. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
4. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.5 TUFTED CARPET (CPT5)

A. Products: Subject to compliance with requirements, provide the following:

1. Mannington; Belvedere V.
2. Color/Pattern: Ambergris.

B. Fiber Type: 6,6 Nylon.

C. Dye Method: Piece dyed.

D. Pile Characteristic: Solid color cut pile.

E. Density: 115.

F. Pile Thickness: 0.222 inches.

G. Stitches: 13.33 per inch.

H. Gage: 1/10.

I. Tufted Yarn Weight: 36 oz./sq. yd..

J. Primary Backing: 100% Synthetic woven polypropylene.

K. Secondary Backing: 100% Synthetic woven polypropylene.

L. Width: 12 feet.

M. Performance Characteristics: As follows:

1. Flooring Radiant Panel: ASTM E648 Direct Glue Down Mode – Class 1
2. NBS Smoke Chamber: ASTM E662 Flaming Mode – 450 or less
3. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
4. Environmental Requirements: Provide carpet that complies with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.

2.6 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. Use adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

D. Seam Sealer: Edge of carpet sealer product recommended by carpet manufacturer for sealing and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

Masland contract

Construction specifications

Product	Voluta
Style #	7459
Fiber Content	Antron® Legacy nylon
Fiber Weight (tufted)	32 oz./Sq. Yd. (1085 g/m²)
Construction	Tip Sheared Loop Pattern
Pattern Repeat	18” W x 20”L (45.72 cm x 50.80 cm)
Dye Method	Skein Dyed
Gauge	1/12
Width	12’ (3.66)
Pile Height	.384”/ .256”/ .128” (9.75 mm/6.50 mm/3.25 mm)
Total Weight	78 oz./Sq. Yd. (2645 g/m²)

Performance specifications

Flammability Rating:	Flooring Radiant Panel ASTM E-648 and/or NFPA 253. Greater than 0.45 watts / CM² Class 1. (EU) CFL S1
Smoke Density:	Passes NBS Smoke Chamber Test ASTM E-662
Colorfastness	4.0 or better
Static Rating:	Less than 3.0 kV
Warranty:	10 year warranty
Primary Backing	Woven Polypropylene
Secondary	Woven Polypropylene with Unitary
DuraTech® Soil Resistant Treatment:	A commercially durable treatment provides extra protection against soiling.

Tufted fiber weight denotes specs prior to tip shearing. Tip Shearing removes a small amount of fiber, which will vary slightly by product and production run.

This product is certified GOLD by the NSF 140-2007 Sustainable Carpet Standard.

Voluta meets the standards for the Carpet & Rug Institute's Indoor Air Quality Green Label Carpet Testing Program. Certification # GLP1678.

Product Specifications

BELVEDERE V 36 – STANDARD SYNTHETIC BACKING (40 Yard Minimum)

MANNINGTON COMMERCIAL

PHYSICAL CONSTRUCTION:

CONSTRUCTION:	Solid Color Cut Pile
FACE FIBER:	Type 6,6 Nylon
DYE METHOD:	Piece Dyed
GAUGE:	1/10
STITCHES PER INCH:	13.33
PILE THICKNESS:	.222 Inches
TUFT DENSITY:	115
TUFTED YARN WEIGHT:	36 Ounces Per Square Yard
DENSITY:	Average Density = 5,837; Weight Density = 210,161
PRIMARY BACKING:	100% Synthetic Woven Polypropylene
SECONDARY BACKING:	100% Synthetic Woven Polypropylene
STANDARD SIZE:	12’ Width
PATTERN REPEAT:	None

ENVIRONMENTAL:

MANUFACTURE LOCATION:	Calhoun, Georgia 30701 USA
CRI GREEN LABEL PLUS ID:	GLP0678

WARRANTIES:

WARRANTY:	10 Year Limited Warranty, Covering Loss of Face Wear and Static Protection

PRODUCT TESTING:

RADIANT PANEL (ASTM E-648):	Class I (Direct Glue)
SMOKE CHAMBER (ASTM-E-662):	Less than 450 (Flaming Mode)
METHENAMINE PILL TEST (ASTM D-2859):	Passes
ELECTROSTATIC PROPENSITY (AATCC 134):	Less than 3.0 KV

RECOMMENDED ADHESIVE:

MULTI-PURPOSE ADHESIVE:	Mannington Ultra Adhesive
CRI GREEN LABEL PLUS ID:	GLP70513
VOC LIMITS:	Meets SCAQMD Rule #1168
BOND WARRANTY:	10 Year Limited Warranty When Used With Mannington Carpet

Specifications are subject to normal manufacturing variances. Specifications are subject to change without notice when technological advancements provide improved product performance.

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Wood.
5. Gypsum board.
6. Cotton or canvas insulation covering.

B. This Section includes exposed interior items and surfaces with low VOC coatings complying with ME DEP regulations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Akzo Nobel Paints, LLC (Glidden Professional, Devoe Coatings, Flood Stains)
2. Benjamin Moore & Co.
3. Sherwin-Williams Company (The).
4. Tnemec Company, Inc. (Tnemec).

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Compliance for Interior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Department of Environmental Protection Regulation, "Chapter 151: Architectural and Industrial Maintenance (AIM) Coatings" and the following chemical restrictions expressed in grams per liter:

1. Flat Paints and Coatings: VOC content of not more than 100 g/L.
2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
3. Non-Flat Paints and Coatings - High Gloss: VOC content of not more than 250 g/L.
4. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
5. Fire Resistive Coatings: VOC content of not more than 350 g/L.
6. Industrial Maintenance Coatings (IMC): VOC content of not more than 340 g/L.
7. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
8. Quick-Dry Enamels: VOC content of not more than 250 g/L.
9. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
10. Specialty Primers, Sealers, and Undercoaters: VOC content of not more than 350 g/L.
11. Stains: VOC content of not more than 250 g/L.
12. Wood Preservatives: VOC content of not more than 350 g/L.

C. Colors: Provide color selections made by the Architect. Allow for up to 15 different color selections.

2.3 BLOCK FILLERS

A. Latex Block Filler:

1. Devoe Coatings: Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler. (67 g/L)

2. Moore: Latex Block Filler No. M88.
3. S-W: PrepRite Block Filler Interior/Exterior Latex B25W25 Series. (45 g/L)

2.4 PRIMERS/SEALERS

A. Low-VOC Latex Primer/Sealer:

1. Moore: Pristine Eco Spec Interior Latex Primer Sealer, No. 231
2. Glidden Professional: 9116-1200 LifeMaster No VOC Interior Primer. (0 g/L)
3. SW: ProMar 200 Zero VOC Interior Latex Primer B28W02600 Series. (0 g/L)

B. High-Build Primer/Sealer:

1. Glidden Professional: 1040-1200, High Build Surfacer Interior Primer Sealer. (VOC 100g/L)
2. SW: PrepRite High Build Interior Latex Primer/Surfacer B28W601 (VOC 74 g/L).
3. Moore: Super Spec Satin-Fil 172 (VOC 31g/L)

2.5 METAL PRIMERS

A. Rust-Inhibitive Primer (Water Based):

1. Devoe Coatings: 4020-1000 Devflex 4020PF DTM Primer & Flat Finish. (91 g/L)
2. Moore: IMC Acrylic Metal Primer M04. (51 g/L)
3. S-W: IMC Pro-Cryl Universal Primer, B66-310 Series. (100 g/L)

2.6 WOOD PRIMERS

A. Latex-Based Wood Primer:

1. Glidden Professional: 3210-1200 Gripper Interior/Exterior Primer Sealer. (100 g/L)
2. Moore: Super Spec Latex Enamel Undercoater & Primer Sealer #253.
3. S-W: PrepRite Classic Latex Primer B28W101 Series.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.7 WATER-BASED PAINTS

A. Low-VOC Latex (Flat):

1. Glidden Professional: 9100-XXXXN LifeMaster No VOC Interior Flat Paint (0 g/L)
2. Moore: Eco Spec Interior Latex Flat, No. 219.
3. SW: ProMar 200 Zero VOC Interior Latex Flat B30-2600 Series. (0 g/L)

B. Low-VOC Latex (Low Luster):

1. Glidden Professional: 9300-XXXX LifeMaster No VOC Interior Eggshell Paint (0 g/L)
2. Moore: Pristine Eco Spec Interior Latex Eggshell, No. 223
3. SW: ProMar 200 Zero VOC Interior Latex Eg-Shell B20-2600 Series. (0 g/L)

C. Low-VOC Latex (Semigloss):

1. Glidden Professional: 9200-XXXXN LifeMaster No VOC Interior Semi-Gloss Paint (0 g/L)
2. Moore: Pristine Acrylic Semi-Gloss, No. 214
3. SW: ProMar 200 Zero VOC Interior Latex Semi-Gloss B31-2600 Series. (0 g/L)

2.8 HIGH PERFORMANCE EPOXY PAINTS

A. Waterborne Epoxy Finish:

1. Moore: Moorcraft Super Spec Acrylic Epoxy Coating No. 256.
2. Glidden Professional: IMC 4408-XXXX Tru-Glaze-WB Waterborne Epoxy Gloss Coating. (206 g/L)
3. S-W: IMC Water Based Catalyzed Epoxy Gloss, B70 Series. (200 g/L)

2.9 DRY FOG/FALL COATINGS

A. Interior Acrylic Dry Fog/Fall:

1. Tnemec: Uni-Bond DF, Series 115. No substitutions.

2.10 FLOOR COATINGS

A. Latex Floor and Porch Paint (Low-Luster):

1. Moore Latex Floor & Patio Enamel 122.
2. Glidden Professional: 3018N Interior/Exterior Water-Based Porch & Floor Satin Enamel. (43 g/L)
3. S-W: Porch & Floor Enamel, Interior/Exterior A32-100 Series. (45 g/L)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints. Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants.

H. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

I. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

J. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.

1. Do not tint prime or base coat for multi-colored finishes.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces. When using colors such as red, yellow or orange, an extra coat of finish may be necessary. Notify Architect when additional coats do not fix the problem.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Not applicable.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in paragraph 2.2 of this Section.

B. Concrete Substrates, Nontraffic Surfaces:

1. Low-VOC Latex System:

a. Prime Coat: Latex block filler.
b. Intermediate Coat: Latex paint matching topcoat.
c. Topcoat: Low-VOC Latex Semi-Gloss paint.

2. High-Performance Epoxy System:

a. Prime Coat: Latex block filler.
b. Intermediate Coat: High-performance epoxy matching topcoat.
c. Topcoat: High-performance epoxy semigloss.

C. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Coating System:

a. Prime Coat: Latex floor and porch paint (low gloss).
b. Intermediate Coat: Latex floor and porch paint (low gloss).
c. Topcoat: Latex floor and porch paint (low gloss).

D. CMU Substrates:

1. Low-VOC Latex System:

a. Prime Coat: Latex block filler.

b. Intermediate Coat: Low-VOC latex paint matching topcoat.
c. Topcoat: Low-VOC latex semi-gloss paint.

2. High-Performance Epoxy System:

a. Prime Coat: Latex block filler.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex (semigloss).

E. Steel Substrates: Including, but not limited to steel doors and frames, steel stairs (including risers and stringers), handrails and guardrails, lintel plates and angles, wood door glass lite kits and astragals, access panels (both sides), metal fabrications; see Division 05 Section "Metal Fabrications", and miscellaneous metal items.

1. Low-VOC Latex Over DTM Primer System:

a. Prime Coat: DTM anticorrosive metal primer.
b. Intermediate Coat: Low-VOC latex paint matching topcoat.
c. Topcoat: Low-VOC latex semi-gloss paint.

2. High-Performance Epoxy System:

a. Prime Coat: DTM anticorrosive metal primer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex (semigloss).

F. Galvanized-Metal Substrates:

1. Low-VOC Latex Over DTM Primer System:

a. Prime Coat: DTM anticorrosive metal primer.
b. Intermediate Coat: Low-VOC latex paint matching topcoat.
c. Topcoat: Low-VOC latex semi-gloss paint.

G. Exposed Steel Ceiling Substrates: Including, but not limited to, structural support framing, metal deck, mechanical and electric piping, and ductwork.

1. DryFog/Fall System: Single coat application in accordance with manufacturer’s instructions.

H. Wood Substrates: Including wood trim and wood-based panel products.

1. Low-VOC Latex System:

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Low-VOC latex paint matching topcoat.
c. Topcoat: Low-VOC latex (semigloss) paint.

I. Gypsum Board Substrates:

1. Low-VOC Latex System:

a. Prime Coat: Low-VOC latex primer/sealer.
b. Intermediate Coat: Low-VOC latex paint matching topcoat.

c. Topcoat: Low-VOC latex (flat) paint for ceilings, (eggshell) paint for walls.

2. High-Performance Epoxy System:

a. Prime Coat: Latex primer/sealer.
b. Intermediate Coat: High-performance epoxy matching topcoat.
c. Topcoat: High-performance epoxy (semigloss).

J. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

1. Low-VOC Latex System:

a. Prime Coat: Low-VOC latex primer/sealer.
b. Intermediate Coat: Low-VOC latex paint matching topcoat.
c. Topcoat: Low-VOC latex (flat) paint.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and application of wood finishes on the following substrates:

1. Interior Substrates:

a. Dressed lumber (finish carpentry).
b. Exposed wood panel products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
2. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. VOC content.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain sealer materials for each coating system from the same manufacturer as the finish coats.

C. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.

a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Akzo Nobel Paints, LLC (Glidden Professional, Devoe Coatings, Flood Stains)
2. Benjamin Moore & Co.
3. PPG Architectural Finishes, Inc.
4. Samuel Cabot Incorporated.
5. Sherwin-Williams Company (The)

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles for the category indicated.

2.2 MATERIALS, GENERAL

A. Material Compatibility:

1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

B. VOC Compliance for Interior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Department of Environmental Protection Regulation, "Chapter 151: Architectural and Industrial Maintenance (AIM) Coatings" and the following chemical restrictions expressed in grams per liter:

1. Flat Paints and Coatings: VOC content of not more than 100 g/L.
2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
3. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
6. Floor Coatings: VOC not more than 100 g/L.
7. Shellacs, Clear: VOC not more than 730 g/L.
8. Stains: VOC not more than 250 g/L.

C. Stain Colors: As selected by Architect from manufacturer's full range.

2.3 STAINS

A. Interior Wood Stain (Semitransparent):

1. PPG: 77-560 REZ Interior Stain Base
2. Glidden Professional: 1700V, Woodpride Interior Wood Stain

2.4 POLYURETHANE VARNISHES

A. Waterborne Clear Acrylic (Satin):

1. Moore: Benwood Stays Clear Acrylic Polyurethane No. 423.
2. Glidden Professional: 1802-1000 WoodPride WB Interior Satin Polyurethane Varnish.
3. S-W: Minwax Polycrylic.
4. PPG: 77-49 REZ Interior Acrylic Polyurethane Satin Clear Finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Interior Wood Substrates: 13 percent, when measured with an electronic moisture meter.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces that will be exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood substrates, nontraffic surfaces, including wood trim and wood-based panel products.

1. Polyurethane Varnish Over Stain System:

a. Stain Coat: Interior wood stain (semitransparent).
b. Two Finish Coats: Interior, oil-modified, clear urethane (satin).

2. Polyurethane Varnish System:

a. One Factory-Applied Finish Coat: Matching field-applied finish coats.
b. Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin).

END OF SECTION 099300

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Dimensional characters.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for signs.

1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
2. Provide typestyles, graphic elements and layout for each sign.

C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:

1. Aluminum.

D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:

1. Aluminum: For each form, finish, and color, on 6-inch- long sections of extrusions and squares of sheet at least 4 by 4 inches.

E. Maintenance Data: For signs to include in maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.

2.2 DIMENSIONAL CHARACTERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. A. R. K. Ramos.
2. ASI-Modulex, Inc.
3. Gemini Incorporated.
4. Metal Arts; Div. of L&H Mfg. Co.
5. Mohawk Sign Systems.
6. Signature Signs, Incorporated.

B. Cast Characters: Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free of pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated. Comply with the following requirements.

1. Character Material: Aluminum.
2. Thickness: As indicated.
3. Color(s): As selected by Architect from manufacturer's full range.
4. Mounting: Concealed studs, noncorroding for substrates encountered.

C. Aluminum Extrusions (support materials): Comply with the following requirements:

1. Finish: Anodized.

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils, medium gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 101400

SECTION 101453 - SITE SIGNS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes all traffic and pedestrian signage within limits of work as indicated on the Drawings.

1. Traffic Guide Signs.
2. Traffic Regulatory, Warning Signs.
3. Parking Signs including ADA signs.
4. Miscellaneous Informational signs.
5. Posts, attachment hardware and accessories.

B. Related requirements:

1. Division 01 Section “Submittal Procedures”
2. Section 321216 Section “Hot Mix Asphalt Pavement”

1.3 QUALITY ASSURANCE

A. Quality, grades of materials and installation procedures: In accordance with applicable code and referenced standards including:

1. American Society for Testing Materials (ASTM).
2. State of Maine, Department of Transportation Standard Specifications (MDOT).
3. Manual on Uniform Traffic Control Devices (MUTCD).

1.4 SUBMITTALS

A. Product Data: All materials.

B. Schedule: Submit schedule of all required signs with drawing of locations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Signs: MDOT 645.03 Type I; engineering grade reflective sheeting letters, numerals, symbols and border on engineering grade reflective sheeting background adhered to sheet aluminum sign panel.

B. Sizes, Colors, Legend Designs: As indicated on drawings and as required by MUTCD and MDOT.

C. Posts:

1. MDOT 720.08; U-Channel posts; aluminum or galvanized steel; Provide two (2) sections of post with break-away attachment.Shall have 3/8" pre-drilled holes, 1-inch on center.
   a. Size: 2-1/4" to 3-1/2" wide by 7/8" min. depth u-channel steel
   b. Color/coating: green enamel coated or painted green on galvanized or zinc oxide primer
2. 1-1/2" O.D. steel pipe, painted green on galvanized or zinc oxide primer. Provide anti-torsion fins at base of buried section.
3. MDOT 720.12 Wood sign posts shall be rectangular, straight and sound timber, cut from live growing native spruce, hemlock, cedar, southern yellow pine, or Douglas Fir trees, free from loose knots or other structurally weakening defects of importance, such as shake or holes and heart rot. They shall be sawn true and planed 4 sides. Posts shall be 4 in by 4 in; with two 1 ½ in diameter holes drilled perpendicular to direction of traffic, one hole centered 4 in above ground level and one centered 18 in above ground level.

D. Attachment Hardware: Aluminum or galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Attach signage to supports with fasteners concealed at face of sign.

B. Install items firmly in place at prescribed locations, straight, plumb, level, and anchored for long life under hard use.

END OF SECTION 101453

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes solid-polymer units as follows:

1. Toilet Enclosures: Overhead braced.
2. Urinal Screens: Wall hung.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.
3. Show locations of centerlines of toilet fixtures.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221.

B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

C. Stainless-Steel Castings: ASTM A 743/A 743M.

2.2 SOLID-POLYMER UNITS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Accurate Partitions Corporation.
2. General Partitions Mfg. Corp.
3. Global Steel Products Corp.
4. Santana Products, Inc.
5. Sanymetal; a Crane Plumbing Company.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall hung.

D. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.

E. Pilaster Shoes: Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

F. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Wall-Hung Urinal Screens: Attach full length bracket on each side of panel to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

GENERAL PARTITIONS

PRODUCT GUIDE

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General Partitions Advantages

* **A leader in the industry with over 50 years of experience, offering the largest selection of partitions in the industry, with 4 different styles, and 9 different types of material.**
- **All of our partitions are proudly made in the USA at either our Union shop in Erie, Pennsylvania – or in our southern facility located in Alabama.**
- **Outstanding customer service since its inception – second to none!**
- **Shipping schedules you can depend on – 98% of all orders shipped within one day of the schedule date.**
- **Our shipments arrive to you safely with our cellular poly crate, which has proven to reduce freight damage. Statistically, 99% of the steel orders arrived to the jobsite damage-free.**
- **Express ship allows your orders to ship as quick as 2 working days**
- **Use of TORX head fasteners with pin to prevent theft and vandalism.**
- **Barrier free design and operational handles to meet ADA requirements.**

Latest projects that we are proud to be part of

Juan Olivas

Estadio-Chavis - Chivas Soccer Stadium Guadalajara
680 compartments: Combination of 40 and 50 floor mounted/overhead braced, and ceiling hung
Material: Anti-Graffiti Powder Coated Steel, Stainless Steel and Solid Phenolic Core

David Fulmer

PNC Ballpark
280 Compartments" of Series 40 floor mounted/over-head braced
Material: Powder Coated Steel

Rob Pongsajapan

Boston Convention Center
250 Compartments: Series 60 floor to ceiling
Material: Stainless Steel

Greg West

Pentagon Wedge 1
240 Compartments: of Series 40 floor mounted/over-head braced
Material: Solid Phenolic Core

Partition Styles

30 SERIES

Where no overhead bracing is required, but ceiling hung partitions are impractical. General Partitions' 30 series (floor supported) is ideal. Modern spaciousness and rigidity are important features.

The 30 Series is also featured in a 54" "Junior Size" which has proved to be a great help with younger children.

40 SERIES

Our most popular style of toilet compartment construction is 40 Series (floor supported with headrail.) It is recommended for new and old buildings where economy, ease of installation, and rigid overhead bracing are required.

50 SERIES

The ease of floor maintenance when General Partitions 50 Series (ceiling hung) style is used, has influenced architects and building owners to utilize this style particularly on construction where dropped ceiling or open span type construction is practical.

60 SERIES

General Partitions' floor to ceiling Series 60 is recommended for all areas subject to heavy usage. For problem areas we recommend the use of full length aluminum brackets and hinges.

EASTERN STYLE

When increased privacy is required

"Eastern style" is an option that can be incorporated into any of our partition series and materials when privacy is a concern

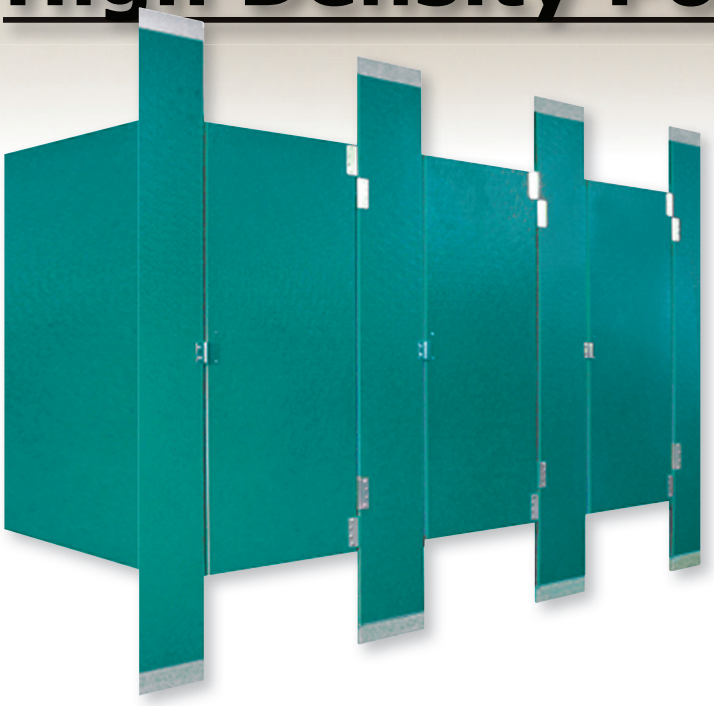
*Panels and doors are specified as 67" high and mounted 3-1/2" off of the floor

"Eastern max style" can also be incorporated into any series and material of partitions when maximum privacy is required

*Panels and doors are specified as 72" high and mounted 3-1/2" off of the floor

*Continuous brackets and no sight door options to minimize any sight gaps

High Density Polymer

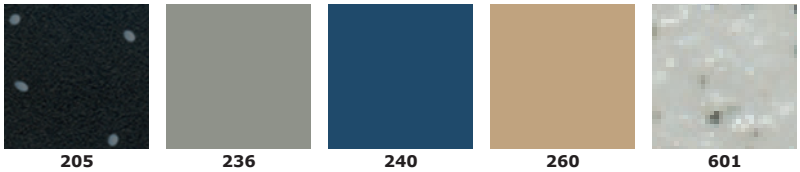


STANDARD
- Heavy duty 8” wraparound and continuous aluminum brackets at all locations adds strength and durability
- Grafitti resistant
- 25 year guarantee

OPTIONS:
- Continuous plastic brackets and shoes
- Integral and continuous hinges
- No sight strike
- Class A and B fire rated

EXPRESS SHIP COLORS

General Partitions is well known in the partition manufacturing industry for having excellent shipping schedules. Express shipment will ship in 5 working days. Our complete color chart is available upon request.



205 GALAXY | 236 STERLING | 240 COLONIAL | 260 SANDSTONE | 601 TOPAZ

OP/OVERALL PRODUCT

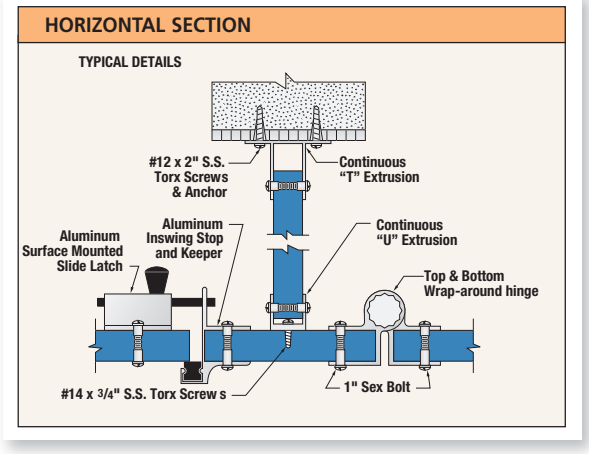
HIGH DENSITY POLYMER

General’s H.D.P. toilet partitions, showers and dressing compartments are manufactured using high density polymer resin. Color is solid thru-out. Compartments cannot rust, rot, delaminate or absorb odors like marble. Water resistant, can be used under any moisture condition. Perfect for shower and dressing compartments as well as toilet partitions.

GREEN ALERT

- We recycle all waste and scrap which is used in the production of our new sheets of HDP
- We use reclaimed material in our production
- Our HDP sheets are completely 100% recyclable
- We also have 100% post consumer HDP partitions available

NOW CLASS “B” FIRE RATING OFFERED



General

Urinal Screens

Wall Hung (WHS)

Screen is 1" thick insulated panel sealed with locking bar and mitered corner reinforcements. Hung from three chrome-plated "T" brackets.

WHS-1 Powder Coated galvanized and bonderized steel.
WHS-3 Stainless steel panel.
WHS-4 Plastic Laminate - High Pressure Laminate.
WHS-6 Solid Phenolic Core (1/2" thick panel).
WHS-10 Fiberglass Reinforced Plastic

Wall Hung Flange (WHF)

Screen is 1" thick insulated panel with continuous anodized aluminum channel.

WHF-1 Powder Coated galvanized and bonderized steel
WHF-3 Stainless steel.
WHF-4 Plastic Laminate - High Pressure Laminate.
WHF-6 Solid Phenolic Core (1/2" thick panel).
WHF-7 High Density Polymer
WHF-10 Fiberglass Reinforced Plastic

Floor Braced Screen (FBS)

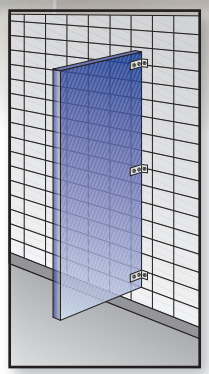
Screen is 1" thick insulated panel supported by a floor supported pilaster (see Series 30 specification).

FBS-1 Powder Coated galvanized, bonderized steel.
FBS-3 Stainless steel.
FBS-4 Plastic Laminate - High Pressure Laminate
FBS-6 Solid Phenolic Core (1/2" thick panel - 3/4" thick pilaster).
FBS-7 High Density Polymer
FBS-10 Fiberglass Reinforced Plastic

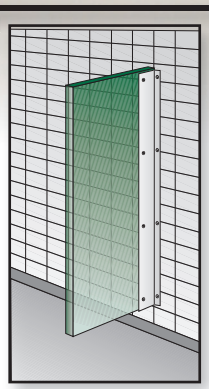
Floor Supported With Headrail (FSH)

Headrail braced 1" thick double-wall panel (see Series 40 specification). Panel set into extra-heavy wall extruded aluminum pilaster. Stainless steel floor shoe.

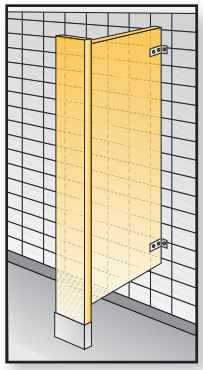
FSH-1 Powder Coated galvanized, bonderized steel panel and integrated extruded aluminum pilaster.
FSH-3 Stainless steel panel with integrated painted rustproof, aluminum pilaster.
FSH-4 Plastic Laminate - High Pressure Laminate 40 Series Pilaster attached to panel with chrome-plated offset brackets thru bolted.
FSH-6 Solid Phenolic Core (1/2" thick panel - 3/4" thick pilaster). Pilaster attached to panel.
FSH-7 High Density Polymer. Pilaster attached to panel.
FSH-10 Fiberglass Reinforced Plastic. Pilaster attached to panel.



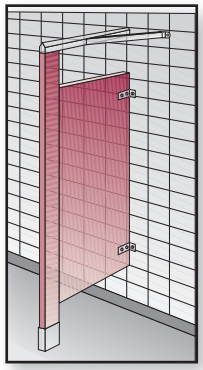
Wall Hung (WHS)



Wall Hung Flange (WHF)



Floor Braced Screen (FBS)



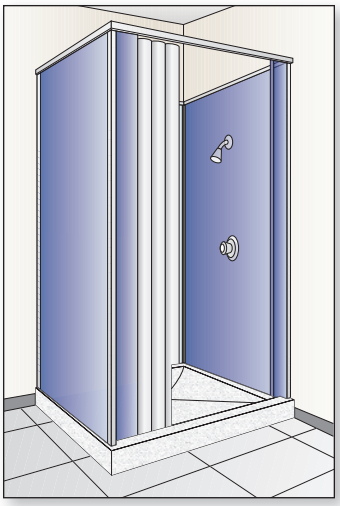
Floor Supported With Headrail (FSH)

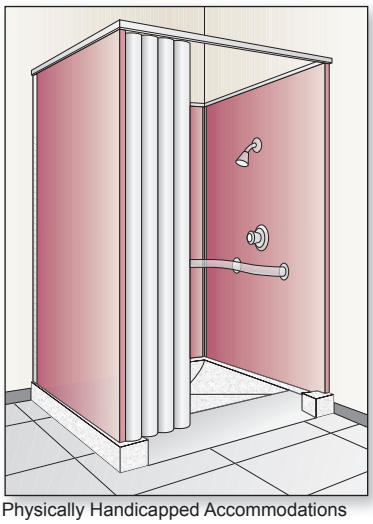
Shower Cabinets and Partitions

General's shower cabinets are available in standard sizes and in finishes to match toilet and dressing compartments. They may be used in units or battery-type installations for institutional projects such as schools, dormitories, clubs, hospitals or industrial buildings.

SHOWER CABINETS

General Partitions' shower is the finest in double-wall unit shower construction. It features a pre-cast terrazzo receptor. Available sizes — 32" x 32" x 82", 36" x 36" x 82", 40" x 40" x 82" Neocorner, 40" x 40" x 82" or 40" x 48" x 82" Handicapped.

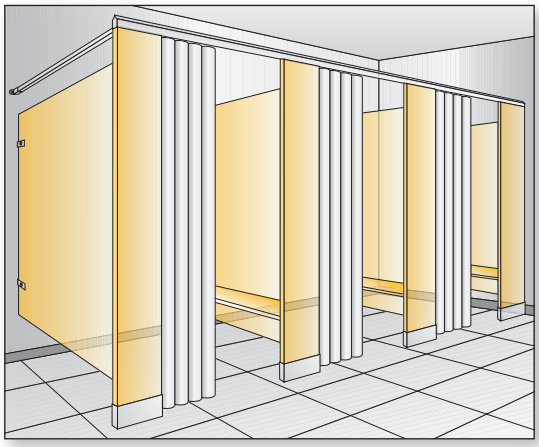




Physically Handicapped Accommodations

Shower/Dressing Compartments

Available in Powder Coated, Stainless steel, F.R.P. (Fiberglass Reinforced Plastic), S.P.C. (Solid Phenolic Core), HDP (High Density Polymer). The S.P.C., HDP, material is non-absorbent, completely water resistant, impervious to steam, soaps and detergents and will not mildew. These features, coupled with the finest hardware available, makes an unbeatable combination.



SECTION 102238 - OPERABLE PANEL PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated, acoustical panel partitions.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
2. Panel Edge Material: Not less than 3 inches long.

E. Delegated-Design Submittal: For operable panel partitions.

1. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Partition track, track supports and bracing, switches, turning space, and storage layout.
2. Suspended ceiling components.
3. Structural members to which suspension systems are attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. HVAC ductwork, outlets, and inlets.
c. Speakers.
d. Sprinklers.
e. Smoke detectors.
f. Access panels.

B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

C. Seismic Qualification Certificates: For operable panel partitions, tracks, accessories, and components, from manufacturer. Include seismic capacity of partition assemblies to remain in vertical position during a seismic event and the following:

1. Basis for Certification: Indicate whether certification is based on analysis, testing, or experience data, according to ASCE/SEI 7.
2. Detailed description of partition anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of operable panel partition.

1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.

E. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

F. Field quality-control reports.

G. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
b. Seals, hardware, track, track switches, carriers, and other operating components.

c. Electric operator and controls.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic bracing of tracks to structure above.

B. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the partition panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."

C. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.
3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E 336, determined by ASTM E 413, and rated for 10 dB less than STC value indicated.

D. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

E. Fire Resistance: Provide fire-rated operable panel partition assemblies complying with NFPA 80, based on testing according to UL 10B for fire-rated door assemblies.

2.2 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hufcor Inc.; 632 Series.
b. Modernfold, Inc.; Acousti-Seal 932.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: Standard widths.

E. STC: Not less than 50.

F. NRC: Not less than 0.50.

G. Panel Weight: 10 lb/sq. ft. maximum.

H. Panel Thickness: Not less than 3 inches.

I. Panel Materials:

1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.

a. Frame Reinforcement: Manufacturer's standard steel or aluminum.

4. Gypsum Board: ASTM C 1396/C 1396M.

J. Panel Closure: Manufacturer's standard unless otherwise indicated.

1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

K. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

2.3 SEALS

A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.
2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.

C. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track.

D. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

1. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1-1/2 inches between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with edges tightly butted, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
2. Match facing pattern 72 inches above finished floor.

B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.

1. Total Weight: Manufacturer’s standard weight.
2. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
3. Color/Pattern: As selected by Architect from manufacturer's full range.

C. Paint: Manufacturer's standard factory-painted finish.

1. Color: As selected by Architect from manufacturer's full range.

D. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:

1. Aluminum: Finished with manufacturer's standard mill finish.

E. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.

2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

1. Multidirectional Carriers: Capable of negotiating intersections without track switches.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

1. Curve-and-Diverter Switches: Allow radius turns to divert panels to an auxiliary track.
2. L Intersections: Allow panels to change 90 degrees in direction of travel.
3. T Intersections: Allow panels to pass through or change 90 degrees to another direction of travel.
4. X Intersections: Allow panels to pass through or change travel direction full circle in 90-degree increments, and allow one partition to cross track of another.
5. Multidirectional Switches: Adjustable switch configuring track into L, T, or X intersections and allowing panels to be moved in all pass-through, 90-degree change, and cross-over travel direction combinations.
6. Center carrier stop.

D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

3.3 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Verify that safety devices are properly functioning.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102238

HUFCOR® THE NEXT GENERATION OF FLEXIBILITY

Operable PARTITIONS

SERIES 600 FEATURES

- FOUR-FINGER, MULTIPLE CONTACT SWEEP SEALS
- "QUICK-SET" TOP AND BOTTOM MECHANICAL SEALS
- STANDARD 1" TOP AND 2" BOTTOM CLEARANCES (DEEPER BOTTOM CLEARANCES OPTIONAL ON SINGLE 4" THICK PANELS)
- WELDED, HEAVY-DUTY 16-GAUGE STEEL FRAME
- PROTECTIVE VERTICAL EDGE TRIM OR OPTIONAL MONOLITHIC EDGES
- GYPSUM AND STEEL ACOUSTICAL FACES WITH TACKABLE SURFACE OPTIONS
- STANDARD VINYL. OPTIONAL FABRIC, CARPET AND CUSTOM FINISHES MAY ALSO BE APPLIED
- WAIST-HIGH SEAL ACTIVATOR FOR FAST, EASY SETUP
- DEEP NESTING, VERTICAL BULLNOSE/ ASTRAGAL SYSTEM

top to bottom:
Customized bottom seals enable these panels to seal against the steps when this University auditorium requires simultaneous sessions.

The beautifully detailed wood veneer faces on these movable panels match the perimeter walls in this upscale restaurant.

Electrically operated partitions easily convert this gymnasium into three classrooms. The Hufgard protection system stops the partition should people or objects obstruct the partition during movement.

This Georgia hotel uses Hufcor omni-directional panels to create multiple meeting spaces. Additional runs of transfer track allow the staff to move the panels without disturbing meetings in progress.

FOR MORE INFORMATION OR TO CREATE YOUR OWN PRELIMINARY DRAWINGS VISIT **www.hufcor.com**

OPERABLE PARTITIONS SPECIFICATIONS

Panel Construction

Panels are a nominal 3" [76] or 4" [102] thick. Panel faces are laminated to the appropriate substrate to meet the STC requirement. Welded frames are of 16 gauge [1.42mm] steel with integral factory applied aluminum vertical edge and face protection. (Optional: no protective vertical face trim for a monolithic look.) Vertical sound seals are of tongue and groove configuration to ensure panel-to-panel alignment and prevent sound leaks between panels. Hinges for pairs or continuously hinged models are recessed and project no more than 1/4" [6] from the panel face.

Seals

Paired & Individual: horizontal top seals are retractable, provide 1" [25] nominal operating clearance, and exert upward force when extended. All panels, including pass door panels and lever closure panels have retractable top and bottom seals. 3" models have standard fixed (sweep) dual 4-finger vinyl top seals but retractable top seals are optional.

Horizontal bottom seals are retractable, provide up to 2" [50] nominal operating clearance and exert downward force when extended. 4" [102] bottom clearance is an available option on Model 641. Automatic bottom seals are optional for 3" single and paired models.

Continuously Hinged (Trains): Electric continuously hinged models have fixed top seals and retractable bottom seals. Fixed bottom seals are an option. 633 manual continuously hinged models have top and bottom fixed seals.

Finishes

The standard face finish is factory-applied vinyl; however, optional carpet, fabric, wood veneers and other custom finishes are available on most models. Panels may also be unfinished for field decoration. The metal trim is powder coated and the matching vinyl seals are available in Lamb's Wool, Gray, or Brown. Custom metal trim colors are available. If a custom trim color is selected, the vinyl sound seals will be furnished in Gray, Brown or Lamb's Wool.

Suspension System

Hufcor track systems have been life-cycle tested for up to 100 miles [161] or approximately 10 years of use.

Acoustics

The partition has been tested in accordance with ASTM E90. A complete, unedited written test report is available upon request. See charts for STC ratings.

ISO Registration

Hufcor U.S. manufacturing facilities' quality systems are registered to the ISO 9001 standards.

Fire-Rated 600-F

One-hour fire rated partitions are available in pairs and single panel models and are identified with an "F" following the model number. They are the same basic construction as the Series 600 and may be finished with any standard Hufcor vinyl, fabric, carpet or any vinyl having a UL Label of 15 or less flame spread. Panel faces may be painted or shipped unfinished for field decoration. The local fire marshal must approve any field applied surface material.

The partition closure must be by lever closure panel which terminates in either a wall recess of a minimum 1-3/8" [35] in depth or surface wall jambs not to exceed 1-3/8" [35] protrusion.

Fire-rated panels are listed as a one-hour Special Purpose Fire Door assembly, tested to UL 10B, ASTM E152 or NFPA 252 standards. The listing includes all variations of the panel configuration, tracks, hardware, end conditions, options, finishes and pass doors contained in the project design.

Warranty

Series 600 and 600-F partitions are guaranteed for two years against defects in material and workmanship, excluding abuse.

Details and editable specifications can be downloaded from Hufcor's website, **www.hufcor.com**. *Complete specifications and details may also be found in our Architectural Product Manual.*

630 SERIES STC & Hanging Weights

Models	Sound[1] Transmission Class (STC)	Hanging Weight[2] Lbs./Sq.Ft. [Kg./Sq.M]
631/632/633	51	10.2 [49.8]
631/632/633	49	8.9 [43.5]
631/632/633	47	7.8 [38.1]
631/632/633	43	7.3 [35.6]
631/632/633	41	5.7 [27.8]

640 SERIES STC & Hanging Weights

641/642/643	54	10.9 [53.2]
641/642/643	52	9.5 [46.0]
641/642/643	49	8.5 [41.2]
641/642/643	47	8.0 [38.7]
641/642/643	43	7.8 [37.8]

[1] Sound Transmission Class (STC). Not all substrates are available for all STCs.
[2] Estimated standard panel weight. Weight will vary based on size, substrate and options. Allow approx. 3.6 lbs./lin ft. [5.3 kg/m] for track. Add 140 lbs. [63 kg] for pass door; add 5 lbs./lin. ft. [7.4 kg/m] of height for Lever Closure Panel. Weights are calculated for a single line of panels only.

Note: Metric dimensions are in [ ]

630 SERIES Stack Sizes

Configuration	Model(s)	Nominal Stack Depth
Paired	632	3-3/4" [95] per panel + 1" [25] (for Type 38 track) 4" [102] per panel + 1" [25] (for Type 40, 11 track)[1]
Individual (Omni)	631	3-3/4" [95] per panel + 1" [25][1]
Continuously Hinged (Train)	633 (manual) 633E (electric)	4" [102] per panel + 8-1/2" [216]

640 SERIES Stack Sizes

Paired	642/642F	4-1/4" [108] per panel + 1" [25][1, 2]
Individual (Omni)	641/641F	4-1/4" [108] per panel + 1" [25][1, 2]
Continuously Hinged (Train)	643E (electric)	4-1/4" [108] per panel + 8-1/2" [216]

[1] Stack size shown is for retractable bottom seals. Use of optional face material may increase stack dimensions.
[2] For fire rated models, add 1-1/2" [38] in lieu of 1" [25].

Operable Partitions
SERIES 600

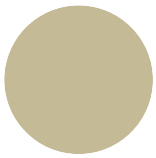
Operable Partitions, also referred to as "airwalls" or flat panels, deliver unlimited space division and acoustical separation. Choose from paired or continuously hinged models for wall-to-wall space separation or single panels for optimum room flexibility. As the world's leading manufacturer of partitions, we have models for every budget and need. For facilities with special requirements, our engineering department can make recommendations or custom design partitions.

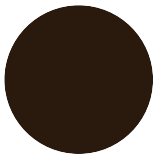
The Hufcor 600 Series operable partition is the most versatile and aesthetically pleasing operable wall constructed today. It combines the durability of a welded steel frame with the design versatility of various acoustical and decorative face constructions.

The panel design enables the 600 series to be manufactured with Hufcor's quick-set mechanical top and bottom seals that provide the most reliable and fastest in-field operation. Hufcor's time-tested protective edge trim is standard on both the 3" and 4" thick models yet both can be supplied with a monolithic, untrimmed edge. The deep nesting, interlocking bullnose/astragal and integrated seals provide a reliable vertical seal that keeps out sound.

Trim Colors – Standard

The 600 Series is available in three standard trim colors – Lamb's Wool, Brown or Gray. Custom colors for metal trim are also available for an upcharge.


Lamb's Wool


Brown


Gray

Pass Door Features

Hufcor's pass door has been designed to provide optimal in-field performance. Features include:

- Rigid steel truss frame for durability
- ADA compliant push-pull door hardware
- Protective edge trim for durability and visual requirements identified by International Building Code
- Perimeter compression seals
- No exposed fasteners on inside of door frame
- Positive latching door hardware
- Edge activated bottom seals with downward seal force to stabilize door in opening
- Door leaf compensates for floor variances with a field adjustable mechanical bottom seal

Model Number Chart

When specifying the Hufcor 600 series, simply choose performance features – STC rating, seal system, trim color, protective edge trim, pass doors, finishes – as needed on the project. Our model numbers are easy to understand once you know the code (see the code chart below).

MODEL NUMBER CHART

First Digit 6: 600 Series

Second Digit 3 or 4:
3" or 4" thick panels

Third Digit:
1 for single models; 2 for paired models; 3 for continuously hinged (train) models

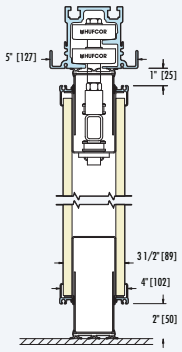
Fourth Digit:
E for Electric operation;
F for Fire-Rated

1st Digit	2nd Digit	3rd Digit	4th Digit	
Series	Panel Thickness	Configuration	Optional Code for Special Requirements	Model Number
6	3" [76]	Single Panels		**631**
6	3" [76]	Paired Panels		**632**
6	3" [76]	Continuously Hinged (Train)	E = Electric Operation	**633, 633E**
6	4" [101]	Single Panels	F = Fire Rated Model Available	**641, 641F**
6	4" [101]	Paired Panels	F = Fire Rated Model Available	**642, 642F**
6	4" [101]	Continuously Hinged (Train)	E = Electric Operation	**643E**

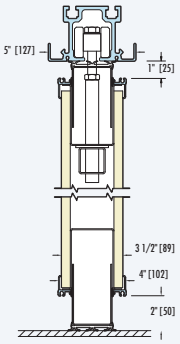
Note: Metric dimensions are in [ ]

600 SERIES SECTIONS

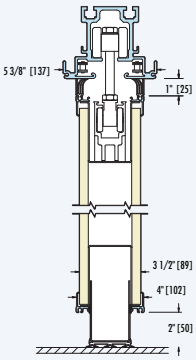
Model 641
Individual
2" bottom seals



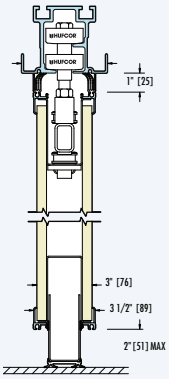
Model 642
Paired



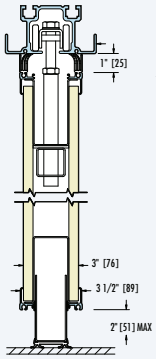
Model 643E
Electric
Continuously Hinged



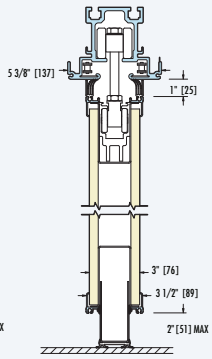
Model 631
Individual



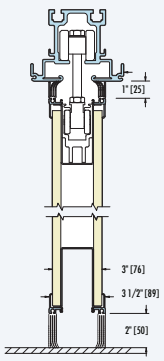
Model 632
Paired



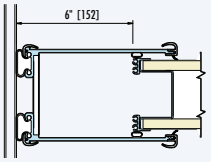
Model 633E
Electric
Continuously Hinged



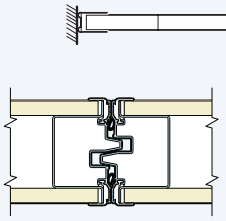
Model 633
Manual
Continuously Hinged



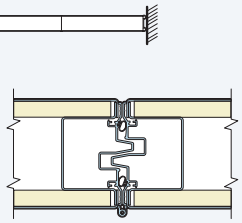
600 HORIZONTAL & OPTIONAL SECTIONS



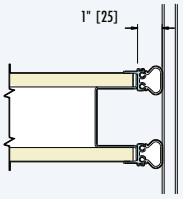
Lever Closure for paired and individual panels



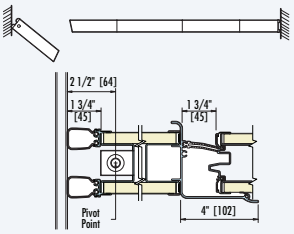
Typical Panel Joint (vertical trim)



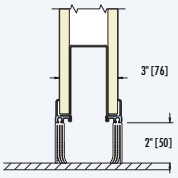
Optional: Typical Panel Joint (no vertical trim)



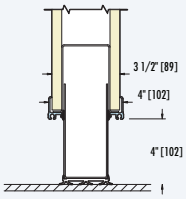
Bulb Seal



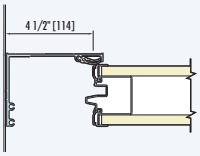
Optional Pivot Closure available on Model 630 paired and individual panels



Bottom Sweep Seals (optional for all models)



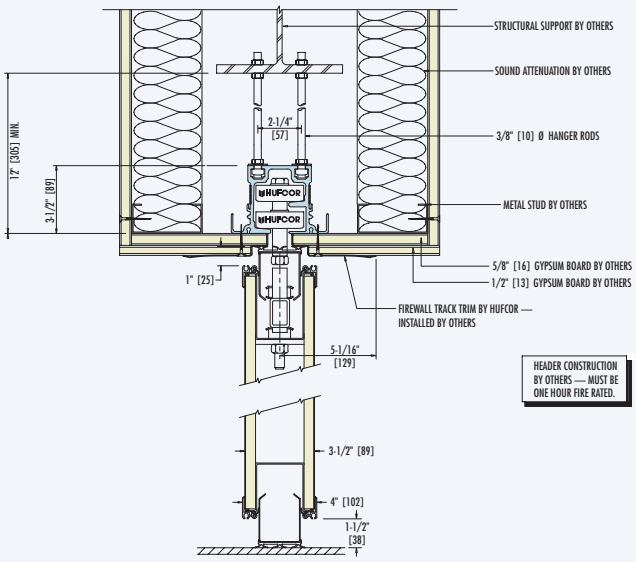
641 Option 4" Retractable Bottom Seals



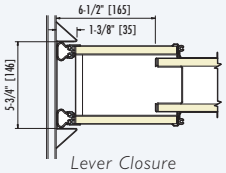
Stack Jamb for Continuously Hinged Models

600-F FIREWALL SECTIONS

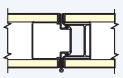
SERIES 641-F
Shown with Type 36 Track



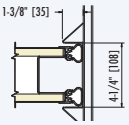
600-F FIREWALL HORIZONTAL SECTIONS



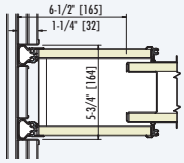
Lever Closure (in exposed jamb)



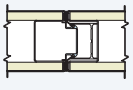
Typical Panel Joint



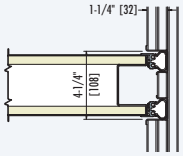
Bulb Seal Joint (in exposed jamb)



Lever Closure (in recess jamb)



Typical Panel Joint



Bulb Seal Joint (in recess jamb)

Note: Metric dimensions are in [ ]

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Extruded Rigid Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.

1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
2. Chemical and Stain Resistance: Tested according to ASTM D 543.
3. Self-extinguishing when tested according to ASTM D 635.
4. Flame-Spread Index: 25 or less.
5. Smoke-Developed Index: 450 or less.

B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

2.2 CORNER GUARDS (CG)

A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90-degree turn to match wall condition.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties Acrovyn SSM-20N corner guards.

2. Cover: Extruded rigid plastic, PVC free, minimum 0.078-inch wall thickness; as follows:

a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
b. Height: 4 feet.
c. Color and Texture: Architect to select colors from manufacturer's full range as needed to match adjacent wall paint.

3. Retainer: Minimum 0.060-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
6. Location: All gypsum wall board outside corner locations.

B. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties Acrovyn CO-8 corner guards.
2. Material: Stainless steel, Type 304.
a. Thickness: Minimum 0.0625 inch.

b. Finish: Directional satin, No. 4
3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
4. Corner Radius: 1/8 inch.
5. Mounting: Adhesive
6. Location: All outside corners and wall ends within Grills/Food Service/Prep/Concession locations.

2.3 FABRICATION

A. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.2 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.3 CLEANING

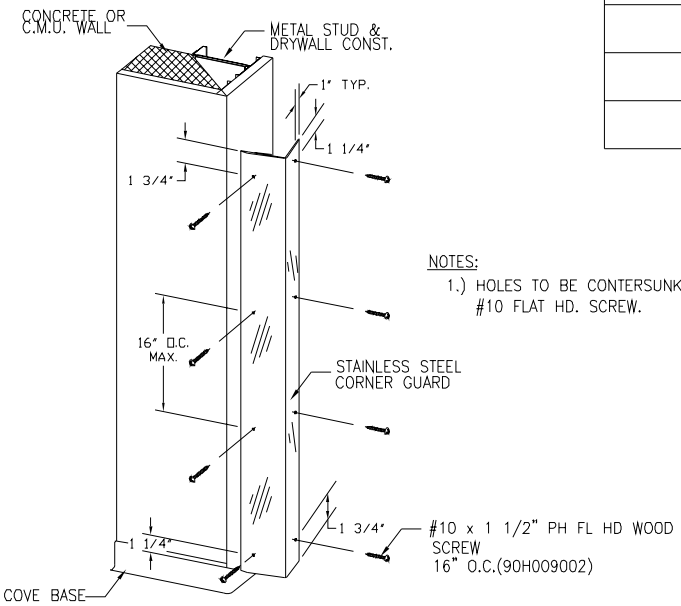
A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

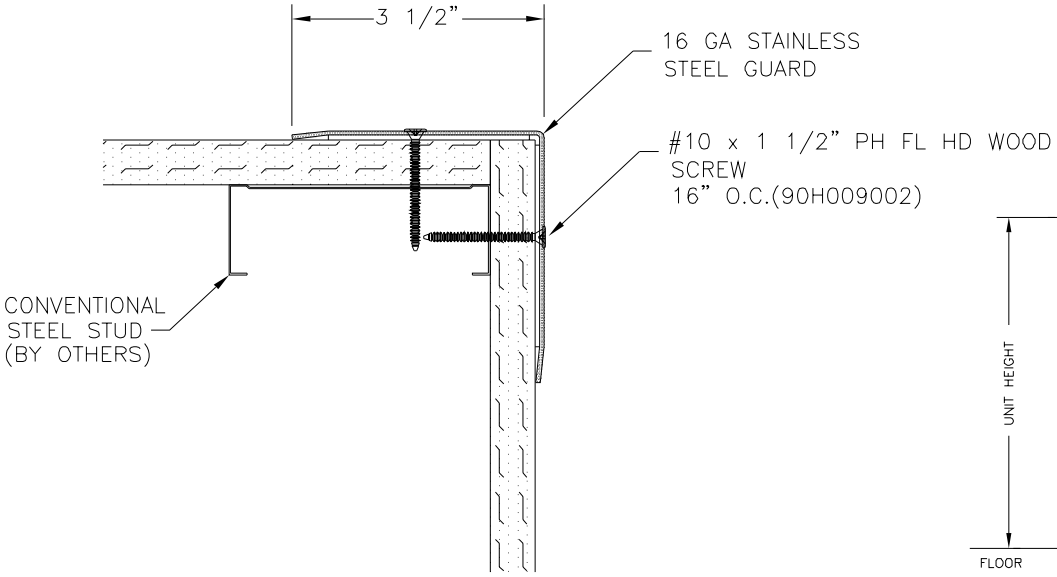
END OF SECTION 102600

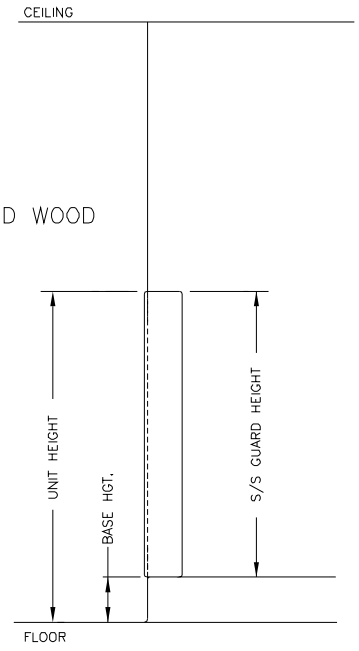
STAINLESS STEEL GUARDS TO BE 16 GA, TYPE #304 ALLOY WITH #4 SATIN FINISH, SHIPPED WITH PROTECTIVE STRIPPABLE COATING.

UNITS REQ'D	UNIT HEIGHT	S/S CG HEIGHT	BASE HGT.



NOTES:
1.) HOLES TO BE CONTERSUNK FOR #10 FLAT HD. SCREW.





C0-8

STAINLESS STEEL GUARD AT PARTIAL HEIGHT ELEVATION

Construction Specialties™
6696 Route 405 Highway, Muncy PA 17756
(800) 233-8493 • Fax (570) 546-4692 • www.c-sgroup.com

PROJECT:		REV. :
LOCATION:		F&F:
CUSTOMER:		SHEET OF
AGENT:		JOB NO.
DWG. BY:	DATE:	

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Public-use shower room accessories.
3. Private-use bathroom accessories.
4. Warm-air dryers.
5. Childcare accessories.
6. Custodial accessories.

B. Owner supplied, contractor supplied items include the following (all items to be mounted to meet ADA guidelines):
1. Toilet Tissue (Roll) Dispenser
2. Liquid-Soap Dispenser
3. Sanitry napkin/tampon vendor
4. Paper towel dispenser (mount with controls and dispenser no higher than 48” AFF)

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Grab Bar (TS-78):

1. Basis-of-Design Product: Bobrick No. B-6806.99 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

C. Grab Bar (TS-88):

1. Basis-of-Design Product: Bobrick No. B-68616.99 Series.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: 36 inch wide by 24 inch deep for tub-shower.

D. Sanitary-Napkin Disposal Unit (TS-56):

1. Basis-of-Design Product: Bobrick No. B-270.
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

E. Sanitary-Napkin Disposal Unit (TS-57):

1. Basis-of-Design Product: Bobrick No. B-354.

2. Mounting: Recessed mounted in partitions.
3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

F. Mirror Unit (TS-43):

1. Basis-of-Design Product: Bobrick No. B-290 custom size.
2. Frame: Stainless-steel channel with J-mold at botto..
    a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: Custom as indicated on Drawings.

G. Mirror Unit (TS-44):

1. Basis-of-Design Product: Bobrick No. B-290.
2. Frame: Stainless-steel channel with J-mold at bottom.
    a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: 24 by 72 inches.

H. Mirror Unit (TS-40):

1. Basis-of-Design Product: Bobrick No. B-165.
2. Frame: Stainless-steel channel.
    a. Corners: Welded and ground smooth.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
4. Size: 24 by 30 inches.

I. Mirror Unit (TS-41):

1. Basis-of-Design Product: Bobrick B-293.
2. Frame: Stainless steel, fixed tilt.
    a. Corners: Welded and ground smooth.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

   a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.

4. Size: 24 by 30 inches.

2.3 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Shower Curtain Rod (TS-83):

1. Basis-of-Design Product: Bobrick No. B-6107.
2. Description: 1-inch OD; fabricated from nominal 20 gage-thick stainless steel.
3. Mounting Flanges: Stainless-steel flanges designed for exposed fasteners.
4. Finish: No. 4 (satin).

C. Shower Curtain (TS-83):

1. Basis-of-Design Product: Bobrick No. 204-2.
2. Size: Minimum 6 inches wider than opening by 72 inches high.
3. Material: Vinyl, minimum 0.006 inch thick, opaque, matte.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat (TS-85):

1. Basis-of-Design Product: Bobrick No. B-5181.
2. Configuration: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
3. Seat: White vinyl padded seat.
4. Mounting Mechanism: Stainless steel, No. 4 finish (satin).

E. Soap Dish (TS-82):

1. Basis-of-Design Product: bobrick B-7680.
2. Description: Without washcloth bar.
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

F. Robe Hook (TS-81):

1. Basis-of-Design Product: Bobrick B-7672.

2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.4 WARM-AIR DRYERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
5. World Dryer Corporation.

B. Warm-Air Dryer (TR-35):

1. Basis-of-Design Product: XLerator, model XL-W.
2. Mounting: Surface mounted.
3. Operation: Electronic-sensor activated with timed power cut-off switch.

a. Operation Time: 10 to 15 seconds.

4. Cover Material and Finish: Cast iron, with enamel finish in color selected by Architect.
5. Electrical Requirements: 115 V, 12.5 A, 900 W.

C. Warm-Air Dryer (TR-40):

1. Basis-of-Design Product: World Model RA.
2. Mounting: Recessed.
3. Operation: Touch-button activated with timed power cut-off switch.

a. Operation Time: 30 to 40 seconds.

4. Cover Material and Finish: Steel, with white enamel finish.
5. Electrical Requirements: 115 V, 20 A, 2300 W.

2.5 CHILDCARE ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Koala Kare Products; a division of Bobrick Washroom Equipment, Inc.

B. Diaper-Changing Station (TS-47):

1. Basis-of-Design Product: Horizontal Baby Changing Station, KB100.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

a. Engineered to support a minimum of 400-lb static load when opened.

3. Mounting: Surface mounted, with unit projecting not more than 4 inches from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE with plastic-laminate insert in color selected by Architect.
6. Liner Dispenser: Built in.

2.6 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bradley Corporation.
4. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.

B. Mop and Broom Holder:

1. Basis-of-Design Product: Fiat No. 889-CC.
2. Description: 0.0375-inch thick, stainless-steel hat channel with four spring-loaded, rubber, cam-type, mop/broom holders.
3. Length: 24 inches.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

2.7 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

WASHROOM ACCESSORIES

BOBRICK

BUILDING VALUE SINCE 1906

ConturaSeries® Accessories

Unique ConturaSeries TowelMate™, Standard Feature at No Extra Charge, Reduces Towel Usage up to 20%.

- Dispenses one towel at a time.
- Field installation into existing cabinets without tools.
- Easy-load channel/retainer saves time.
- US EPA Reduce & Reuse Resource Conservation Initiative compliance.
- Fabricated of 50%-70% recycled stainless steel.

Unique ConturaSeries LinerMate®, Standard Feature at No Extra Charge, Improves Restroom Appearance.

- Liner overhang is eliminated.
- Gapless fit eliminates misdirected trash from collecting outside liner.
- Saves maintenance time and expense by reducing the frequency of liner change-overs.
- Easy installation and removal of liners without unlocking waste receptacle.

TowelMate and LinerMate Accessories for Installation in Existing Models.

- TowelMates fit ConturaSeries units manufactured before June 2010, and are standard thereafter.
- LinerMates fit ConturaSeries waste receptacles.
- Patents pending.

ConturaSeries Overview:

- Original curvilinear architectural design for prestige restrooms.
- 27° doors, flanges and panels.
- Drawn, one-piece seamless, welded construction.
- Type 304 satin-finish stainless steel on all exposed surfaces.
- Bobrick-keyed flush locks.
- Stainless steel piano-hinges.
- Green: Fabricated of 50%-70% recycled stainless steel.
- ConturaSeries is a registered trademark of Bobrick Washroom Equipment, Inc.

Specify ConturaSeries for Class A Properties:

- Corporate headquarters.
- Commercial office buildings.
- Upscale hotels and resorts.
- Specialty retail and fine dining.
- Museums and civic icons.

TrimLineSeries™ Accessories

TrimLineSeries Overview:

- Doors have 90° return, concealed flanges.
- Type 304 satin-finish stainless steel on all exposed surfaces.
- Bobrick-keyed tumbler locks.
- Green, fabricated of 50%-70% recycled stainless steel.

Specify TrimLineSeries for a Clean, Architectural Design Statement.

- Corporate headquarters.
- Commercial office buildings.
- Upscale hotels and resorts.
- Healthcare and hospitality.

ClassicSeries® Accessories

ClassicSeries Overview:

- Traditional beveled flange treatment.
- Type 304 satin-finish stainless steel on all exposed surfaces.
- Bobrick-keyed heavy duty locks.
- Green, fabricated of 50%-70% recycled stainless steel.

Specify ClassicSeries Where Budget is a Primary Concern.

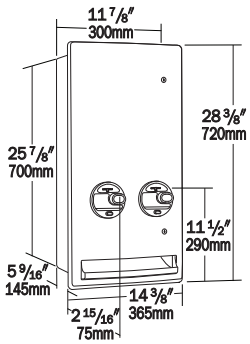
- Mid-size commercial buildings.
- Industrial and manufacturing.
- Theaters and stadiums.
- Healthcare and transportation.

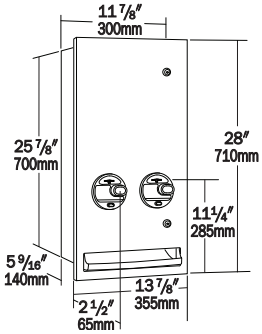
Unique TowelMate reduces towel usage up to 20%.
For more information, including LinerMate. See Page 4.

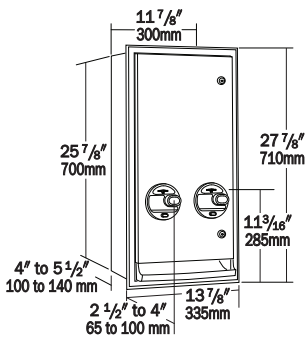
New ADA-Compliant Napkin/Tampon Vendors

Push-Button Operation, Less Than 5 Lb of Force, No Grasping, Pinching or Twisting of the Wrist

- Meets ADA-ABA and ICC/ANSI Accessibility Guidelines for Operation.
- Easy access product tray.
- Single-coin slots are key to jam-resistant operation.
- Accepts one or two quarters (U.S. or Canadian).
- Push-button coin return cancels product selection.
- Patented.
- Returned coins or wrong coins (1¢, 5¢, 10¢) by-pass mechanism and drop into product tray.
- Empty product indicator automatically blocks coin slot.
- Easy product loading, no weights.
- Holds 30 tampons, 20 napkins.
- Two tumbler door locks keyed like other Bobrick accessories.
- Separately-keyed coin box lock for management access.
- Easy 25¢ to 50¢ field coin conversion.
- Type 304 satin-finish stainless steel on exposed surfaces.







ConturaSeries

B-4706 25 RECESSED*
B-4706 50

Door with 27° arc and two flush door locks; soft radius on edges and corners.

B-47064 25 SEMI-RECESSED
B-47064 50

Similar to B-4706, but with stainless steel skirt for semi-recessing in 4″ (100mm) deep walls.

B-47069 25 SURFACE MOUNTED
B-47069 50

Similar to B-4706, but with stainless steel skirt for surface mounting.

TrimLineSeries

B-37063 25 RECESSED*
B-37063 50

Flat door design has 90° returns, conceals flange.

⚡B-370634 25 SEMI-RECESSED*
B-370634 50

Similar to B-37063, but with stainless steel skirt for semi-recessing in 4″ (100mm) deep walls.

B-370639 25 SURFACE MOUNTED
B-370639 50

Similar to B-37063, but with stainless steel skirt for surface mounting.

ClassicSeries

⚡B-3706 25 RECESSED* OR SEMI-RECESSED
B-3706 50

Adjustable seamless beveled flange allows fully-recessed installation in 6″ (150mm) deep walls or semi-recessed installation in 4″ to 6″ (100 to 150mm) deep walls.

⚡B-2706 25 SURFACE MOUNTED
B-2706 50

Similar to B-3706 without adjustable flange for surface mounting.

Series	Model No.	Mounting	Skirt / Flange Depth	Unit Measures W x H x D	Rough Wall Opening (RWO) W x H	RWO Min. Depth	Average Mounting Height	Barrier-Free Mounting Height	Projection from wall (incl. push button)
Contura Series®	B-4706	Recessed	n/a	See Illustration	12 ½″ x 26 ⅜″ 320mm x 670mm	5 9/16″ 140mm	73″ to 77″ to the top of the unit. (1855x1955 mm)	63″ to the top of the unit. (1600 mm)	*2 15/16″ (75mm)
	B-47064	Semi-Recessed	1 ¾″ 45 mm			3 15/16″ 100mm			4 9/16″ (115mm)
	B-47069	Surface	5 ¾″ 145 mm	14 ½″ x 28 ½″ x 8 9/16″ 370x725x220mmm	n/a	n/a			8 9/16″ (220mm)
TrimLine Series™	B-37063	Recessed	n/a	See Illustration	12 ½″ x 26 ⅜″ 320mm x 670mm	5 9/16″ 140mm			*2 ½″ (65mm)
	B-370634	Semi-Recessed	1 11/16″ 45 mm			3 ⅞″ 100mm			*4.0″ (100mm)
	B-370639	Surface	5 9/16″ 140 mm	14″ x 28″ x 8″ 355x710x205mm	n/a	n/a			8.0″ (205mm)
Classic Series®	B-3706	Recessed	Adj. Flange	See Illustration	12 ½″ x 26 ⅜″ 320mm x 670mm	5 ½″ 140mm			*2 ½″ (65mm)
		Semi-Recessed				4″-5 ½″ 100-140mm			*4.0″ (100mm)
	B-2706	Surface	n/a	11 ⅞″ x 25 ⅞″ x 8″ 300x660x205mm	n/a	n/a			8.0″ (205mm)

*Complies with ADA-ABA and ICC/ANSI Protruding Objects Limit of maximum 4″ (100mm) protrusion into circulation path depending on wall depth.

Lavatory Mounted Soap Dispensers

B-826 SERIES LIQUID SOAP DISPENSER

NEW

B-8263 SERIES FOAM SOAP DISPENSER

B-822 SERIES SOAP DISPENSERS

For ease of maintenance and labor savings • Vandal-resistant locking cover and free-turning spout • Corrosion-resistant • Bright-polished spout, cover and escutcheon • High-impact-resistant ABS body and shank • Shatter-resistant polyethylene container • Patented

B-822

B-8221

AUTOMATIC SOAP DISPENSERS, LIQUID AND FOAM

Automatic touch-free sensor eliminates cross contamination. Meets Barrier-Free accessibility standards. Sensor detects user's hand to automatically dispense controlled amount (0.8ml) of soap; activation range is 4″ (100mm) from sensor lens. Reduces soap usage, waste. Bright-polished chrome spout cover.

Dispenses 1000 handwashes per 800ml, 2000 handwashes per 1600ml OneShot® soap refills. Soap refills available from sanitary supply distributors. Red LED light blinks when soap refill is low. Yellow LED light blinks when battery life is low (average battery life 90 soap refills or 2 years). Water-resistant battery compartment and motor housing.

Mounts through 1″ (25mm) diameter hole in lavatory or countertop. Maximum countertop mounting thickness 2″ (50mm). Spacer for use with lavatory rim ¾″ (19mm) or greater is included. Battery requirements: 4 Alkaline D Cells (not included).

B-826 AUTOMATIC, LAVATORY–MOUNTED LIQUID SOAP DISPENSER

B-826.18 Starter Kit Includes B-826 Automatic Lavatory-Mounted Liquid Soap Dispenser, an 800ml lotion soap refill, and 4 Alkaline D Cell batteries.

B-8263 AUTOMATIC, LAVATORY–MOUNTED FOAM SOAP DISPENSER

B-8263.18 Starter Kit Includes B-8263 Automatic Lavatory-Mounted Foam Soap Dispenser, an 800ml foam soap refill, and 4 Alkaline D Cell batteries.

826-20 AC ADAPTER (6V) for one B-826 or B-8263 Automatic Lavatory-Mounted Soap Dispenser.

Available on special order: All-metal soap dispenser for vandal-prone installations. AC Adapter (6V) for up to four B-826 or B-8263 Automatic Lavatory Mounted Soap Dispensers.

OneShot is a registered trademark of Rubbermaid Commercial Products.

LIQUID & LOTION SOAPS, AND SYNTHETIC DETERGENT DISPENSERS:

MODEL NUMBER	CAPACITY	SPOUT LENGTH	MAX. MTG. THICKNESS
⚡B-822	34-fl oz (1.0-L)	4″ (100mm)	4″ (100mm)
⚡B-8221	20-fl oz (0.6-L)	4″ (100mm)	1″ (25mm)
⚡B-8226	34-fl oz (1.0-L)	6″ (150mm)	4″ (100mm)
⚡B-82216	20-fl oz (0.6-L)	6″ (150mm)	1″ (25mm)

IMPORTANT NOTE:

All Bobrick B-822 Series Soap Dispensers are designed to dispense commercially marketed all-purpose hand soaps including liquid and lotion soaps, synthetic detergents, and antibacterial soaps containing PCMX and/or Triclosan. Bobrick soap dispensers are not designed to dispense alcohol-based hand sanitizers or iodine-based surgical soaps.

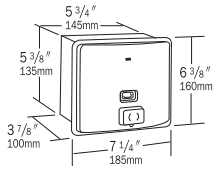
B-822 SERIES DESIGNER'S NOTES:

1. Mount through 1″ (25mm) diameter hole in lavatory or countertop.
2. Diameter of escutcheon: 2 1/16″ (50mm).
3. Maximum height from base of body to bottom of container: 14 5/8″ (370mm) for B-822, B-8226; 8 ¼″ (210mm) for B-8221, B-82216. Allow clearance below basin for 3 ½″ (90mm) diameter container.
4. Mount with end of spout extending over inner edge of bowl.

B-826 AND B-8263 SERIES DESIGNER'S NOTES:

1. Maximum height from base of dispenser to bottom of refill 14 ¼″ (360mm) for 800ml refill; 16 ¼″ (415mm) for 1600ml refill.
2. Allow 5″ (125mm) diameter clearance below lavatory or countertop for motor housing and 800ml refill. For 1600ml refill allow 5 ½″ (140mm) diameter clearance.
3. Battery compartment equipped with 36″ (915mm) cord, mounts on wall under lavatory or countertop.

Soap Dispensers

B-4063 ConturaSeries RECESSED SOAP DISPENSER

Dispenses all-purpose soaps. Drawn, 20-gauge (1.0mm), one-piece front, satin-finish stainless steel with vessel attached to back. Capacity: 50-fl oz (1.5-L). Pulls out for filling. Concealed locking device. Wall to push-button, 1 5⁄8″ (40mm). Rough Wall Opening: 5 7⁄8″ W, 5 1⁄2″ H, 4″ min. depth (150 x 140 x 100mm). Universal/Barrier-Free Mtg. Ht.: 49″ (1245mm) to top of unit with push-button 44″ (1120mm) above floor.

B-4112 ConturaSeries SURFACE MOUNTED SOAP DISPENSER

Corrosion-resistant valve dispenses commercially marketed all-purpose hand soaps. Container is satin-finish stainless steel. Capacity: 40-fl oz (1.2-L). Soap refill window. Concealed wall fastening. Hinged filler-top requires special key to open. Vandal-resistant. Unit 7″ W, 6 1⁄8″ H (180 x 155mm); wall to push-button, 3 5⁄16″ (85mm). Universal/Barrier-Free Mtg. Ht.: 49″ (1245mm) to top of unit with push-button 44″ (1120mm) above floor.

B-2111 ClassicSeries SURFACE MOUNTED SOAP DISPENSER

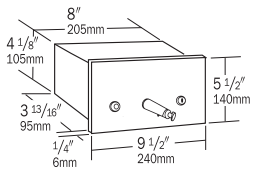
Vertical tank is satin-finish stainless steel. Valve dispenses all-purpose hand soaps. Capacity: 40-fl oz (1.2-L). Soap refill window. Concealed wall fastening. Hinged filler-top requires special key to open. Vandal-resistant. Unit 4 3⁄4″ W, 8 1⁄8″ H (120 x 205mm); wall to push-button, 3 1⁄2″ (90mm). Universal/Barrier-Free Mtg. Ht.: 50 7⁄8″ (1290mm) to top of unit with push-button 44″ (1120mm) above floor.

B-2112 ClassicSeries SURFACE MOUNTED SOAP DISPENSER

Horizontal tank is satin-finish stainless steel. Valve dispenses all-purpose hand soaps. Capacity: 40-fl oz (1.2-L). Soap refill window. Concealed wall fastening. Hinged filler-top requires special key to open. Vandal-resistant. Unit 8 1⁄8″ W, 4 3⁄4″ H (205 x 120mm); wall to push-button, 3 1⁄2″ (90mm). Universal/Barrier-Free Mtg. Ht.: 47 1⁄2″ (1205mm) to top of unit with push-button 44″ (1120mm) above floor.

4112-79 RETROFIT ALL-PURPOSE VALVE

Available for Models B-4063, B-4112, B-2111, B-2112 and B-2014. Field-replaceable corrosion-resistant valve dispenses most commercially marketed all-purpose hand soaps. Valve operates with less than 5 lbs. of force (22.2 N).

B-306 TrimLineSeries RECESSED SOAP DISPENSER

Satin-finish stainless steel. Door: 90° return, conceals flange. Vessel on back of door swings open for filling. Hinge and tumbler lock secure door to cabinet. Capacity: 45-fl oz (1.3-L). Valve dispenses all-purpose soaps. Soap refill window. Rough Wall Opening: 8 3⁄8″ W, 4 3⁄8″ H, 3 7⁄8″ min. depth (215 x 110 x 100mm). Universal/Barrier-Free Mtg. Ht.: 47 3⁄4″ (1215mm) to top; push-button 44″ (1120mm) above floor.

2111-79 SureFlo RETROFIT VALVE

For Models B-11, B-12, B-111, B-112, B-201, B-2014, B-2111, B-202, B-2024, B-306, B-3067; B-310, B-320 and B-330 Series Combination Units. Valve operates with less than 5 lbs. of force (22.2 N).

USA & Canada QuickShip model. USA QuickShip model.

B-290 SERIES WELDED-FRAME MIRRORS

• One-piece, roll-formed ¾″ x ¾″ (19 x 19mm) angle-frame • Type 304 stainless steel angle with satin finish • Corners heliarc welded, ground and polished smooth • Beveled frame edge at mirror for improved appearance • No. 1 quality, ¼″ (6mm) glass mirror; warranted against silver spoilage for 15 years • Galvanized steel back • Secured to concealed wall hanger with theft-resistant mounting

MODEL NO.	W	H		MODEL NO.	W	H	
⚡B-290 1830	18″	30″	(46 x 76cm)	B-290 2448	24″	48″	(61 x 122cm)
⚡B-290 1836	18″	36″	(46 x 91cm)	B-290 2460	24″	60″	(61 x 152cm)
B-290 2430	24″	30″	(61 x 76cm)	B-290 2472	24″	72″	(61 x 183cm)
⚡B-290 2436	24"	36"	(61 x 91cm)				

SPECIAL-ORDER CUSTOM SIZE B-290 SERIES MIRRORS

Maximum size of one piece mirror: 144″ x 72″ (366 x 183cm). Maximum frame size available: 180″ x 72″ (457 x 183cm) with two pieces of glass. To specify special sizes, use Series Number followed by width and height.

B-292 SERIES WELDED-FRAME MIRROR/SHELF COMBINATION

• Same mirror as B-290 Series • Type 304 satin-finish stainless steel shelf • Shelf projects 5″ (127mm), with ¾″ (19mm) return on front and sides; front return edge hemmed for rigidity and safety • Shelf corners heliarc welded, ground and polished smooth

MODEL NO.	W	H		MODEL NO.	W	H	
B-292 1830	18"	30"	(46 x 76cm)	B-292 2436	24"	36"	(61 x 91cm)
B-292 1836	18"	36"	(46 x 91cm)				

SPECIAL-ORDER CUSTOM SIZE B-292 SERIES MIRRORS

Maximum frame size available: 96″ x 72″ (244 x 183cm) with one piece of glass. Maximum size of shelf: 96″ (244cm) furnished as one piece. To specify special sizes, use Series Number followed by width and height.

B-165 SERIES CHANNEL-FRAME MIRRORS

• One-piece, ½″ x ½″ x ⅜″ (13 x 13 x 9.5mm) channel-frame • Type 430 stainless steel with bright-polished finish • Mitered corners • Frame screw permits easy replacement of glass • No. 1 quality, ¼″ (6mm) glass mirror; warranted against silver spoilage for 15 years • Galvanized steel back • Secured to concealed wall hanger with theft-resistant mounting

MODEL NO.	W	H		MODEL NO.	W	H	
⚡B-165 1824	18″	24″	(46 x 61cm)	⚡B-165 2448	24″	48″	(61 x 122cm)
⚡B-165 1830	18″	30″	(46 x 76cm)	B-165 2460	24″	60″	(61 x 152cm)
⚡B-165 1836	18″	36″	(46 x 91cm)	B-165 4836	48″	36″	(122 x 91cm)
⚡B-165 2430	24″	30″	(61 x 76cm)				
⚡B-165 2436	24″	36″	(61 x 91cm)				

SPECIAL-ORDER CUSTOM SIZE B-165 SERIES MIRRORS

Maximum size mirror: 72″ x 60″ (183 x 152cm). To specify special sizes, use Series Number followed by width and height.

B-166 SERIES CHANNEL-FRAME MIRROR/SHELF COMBINATION

• Same mirror as B-165 Series • Type 304 satin-finish stainless steel shelf • Shelf projects 5″ (127mm) with ⅜″ (10mm) return on front and sides; front return edge hemmed for rigidity and safety

MODEL NO.	W	H		MODEL NO.	W	H	
B-166 1824	18″	24″	(46 x 61cm)	B-166 1836	18″	36″	(46 x 91cm)
B-166 1830	18″	30″	(46 x 76cm)	B-166 2436	24″	36″	(61 x 91cm)

SPECIAL-ORDER CUSTOM SIZE B-166 SERIES MIRRORS

Maximum size mirror: 24″ x 60″ (61 x 152cm). Maximum shelf length: 24″ (61cm). To specify special sizes, use Series Number followed by width and height.

⚡ USA & Canada QuickShip model. ⚡ USA QuickShip model.

STANDARD SIZE TEMPERED GLASS MIRRORS

B-2908 SERIES

B-1658 SERIES

Tempered glass mirrors are engineered for heavy-traffic, vandal-prone restrooms in K–12 school buildings, stadiums, outdoor recreation centers and low-supervision facilities such as parks and highway rest stops.

Tempered glass mirrors resist breakage and provide a measure of safety from broken glass, but differ in color and reflective quality from standard glass mirrors. Bobrick uses the highest quality tempered glass mirrors. Modest distortion or heat-generated markings are normal in the tempered glass mirror manufacturing process. Therefore, Bobrick will not accept returns of tempered glass mirrors with random distortion or markings.

B-2908 SERIES STANDARD SIZE TEMPERED GLASS WELDED-FRAME MIRRORS

- Same frame as B-290 Series
- ¼″ (6mm) tempered glass mirror

MODEL NO.	W	H	
B-2908 1830	18″	30″	(46 x 76cm)
B-2908 1836	18″	36″	(46 x 91cm)
B-2908 2436	24″	36″	(61 x 91cm)

B-1658 SERIES STANDARD SIZE TEMPERED GLASS CHANNEL-FRAME MIRRORS

- Same frame as B-165 Series
- ¼″ (6mm) tempered glass mirror

MODEL NO.	W	H	
B-1658 1830	18″	30″	(46 x 76cm)
B-1658 2436	24″	36″	(61 x 91cm)

SPECIAL-ORDER REFLECTIVE SURFACES

Polished Stainless Steel, Tempered and Laminated Glass Mirrors resist breakage and provide a measure of safety from broken glass, but differ in color and reflective quality from standard glass mirrors. Modest distortion is normal and not a returnable condition. Available on special order.

POLISHED STAINLESS STEEL

B-1656 Series Mirrors (up to 60″ x 36″; 152 x 92cm)
B-2906 Series Mirrors (up to 60″ x 24″; 152 x 61cm)

TEMPERED GLASS

B-1658 Series Mirrors (up to 72″ x 48″; 183 x 122cm)
B-2908 Series Mirrors (up to 120″ x 48″; 305 x 122cm)

LAMINATED GLASS

B-1659 Series Mirrors (up to 72″ x 48″; 183 x 122cm)
B-2909 Series Mirrors (up to 84″ x 48″; 214 x 122cm)

DESIGNER'S NOTES:

To specify mirrors, use Series Number desired followed by width and height in inches. Width dimension must always be stated first following Series Number. Framed mirrors are manufactured to overall dimensions, as shown in all mirror tables on pages 20 and 21. Overall height of mirror/shelf models includes shelf. Framed mirrors must be installed with width and height dimensions as ordered. Mirror back and wall hanger cannot be installed side ways to reverse width and height dimensions. Provide minimum ¾″ (19mm) clearance at top of mirror for mounting on wall hanger and 1″ (25mm) clearance on each side.

B-293

B-294

B-293 SERIES FIXED-POSITION TILT MIRRORS

Provide visibility for wheelchair patients. Frame is type 304 stainless steel, satin finish. Beveled edges of frame hug mirror; provides gapless fit for improved appearance, and safety when cleaning mirror. No. 1 quality, ¼″ (6mm) glass mirror; warranted against silver spoilage for 15 years. Mirror extends 4″ (100mm) from wall at top and tapers to 1″ (25mm) at bottom.

MODEL NO.	W	H		MODEL NO.	W	H	
B-293 1630	16″	30″	(41 x 76cm)	**B-293 1836**	18″	36″	(46 x 91cm)
B-293 1830	18″	30″	(46 x 76cm)	**B-293 2436**	24″	36″	(61 x 91cm)

SPECIAL-ORDER CUSTOM SIZE B-293 SERIES MIRRORS

Maximum size mirror: 36″ x 48″ (91 x 122cm).

B-294 SERIES ANGLE-FRAME TWO POSITION TILT MIRROR

Tilt forward to provide full visibility for wheelchair patients or return to upright position. Frame is ¾″ x ¾″ (19 x 19mm), type 304 stainless steel angle, satin finish. Beveled edges of frame hug mirror; provides gapless fit for improved appearance, and safety when cleaning mirror. No. 1 quality, ¼″ (6mm) glass mirror; warranted against silver spoilage for 15 years. Top of mirror tilts 7″ (180mm) from wall with self-locking mechanisms; bottom of mirror mounts to wall with full-length stainless steel hinge.

MODEL NO.	W	H	
B-294 1630	16″	30″	(41 x 76cm)

SPECIAL-ORDER CUSTOM SIZE B-294 SERIES MIRRORS

Maximum size mirror: 24″ x 36″ (61 x 91cm).

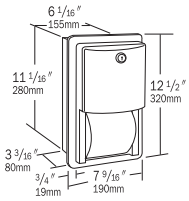
B-1556 SERIES FRAMELESS MIRRORS

Bright-polished stainless steel. Mirror has ¼″ (6mm) return concealing ¼″ (6mm) tempered masonite backing. Furnished with four mounting screws.

MODEL NO.	W	H		MODEL NO.	W	H	
B-1556 1824	17½"	23½"	(44 x 60cm)	**B-1556 2436**	23½"	35½"	(60 x 90cm)
B-1556 1830	17½"	29½"	(44 x 75cm)				

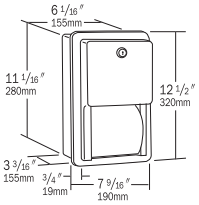
B-942 FRAMELESS MIRROR (FRONT SECURED)

Mirror is 11 ¼″ x 17 ¼″ (285 x 440mm) overall, ¼″ (6mm) deep. 18-gauge (1.2mm), type 430 stainless steel with bright-polished finish.

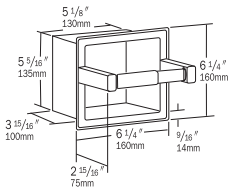
B-4388 ConturaSeries RECESSED MULTI-ROLL TOILET TISSUE DISPENSER

Satin-finish stainless steel unit and dispensing mechanism. Flush tumbler lock. Holds two rolls up to 5 ¼″ (133mm) diameter (1800 sheets). Extra roll drops in place when bottom roll is depleted. Theft-resistant, heavy-duty spindles. Extends 2 ¾″ (70mm) from wall. Rough Wall Opening: 6 ¼″ W, 11 ¼″ H, 3 ¼″ min. depth (160 x 285 x 85mm). Av. Mtg. Ht.: 28 ¾–36 ¾″ (730–935mm) to top of unit; Barrier-Free, 28 ¾″ (730mm).

B-3888 ClassicSeries RECESSED MULTI-ROLL TOILET TISSUE DISPENSER

Satin-finish stainless steel unit and dispensing mechanism. Door has flat face with protruding tumbler lock. Holds two rolls up to 5 ¼″ (133mm) diameter (1800 sheets). Extra roll drops in place when bottom roll is depleted. Theft-resistant, heavy-duty spindles. Extends 2 ¾″ (70mm) from wall. Rough Wall Opening: 6 ¼″ W, 11 ¼″ H, 3 ¼″ min. depth (160 x 285 x 85mm). Av. Mtg. Ht.: 28 ¾–36 ¾″ (730–935mm) to top of unit; Barrier-Free, 28 ¾″ (730mm).

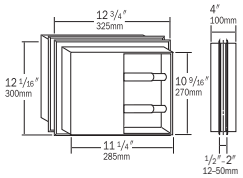



B-663 RECESSED TOILET TISSUE DISPENSER WITH STORAGE SPACE FOR EXTRA ROLL

Bright-polished stainless steel. Chrome-plated plastic spindle holds rolls up to 5 ⅛″ (130mm) diameter (1500 sheets). Recessed cabinet 3 15⁄16″ (100mm) deep holds spare roll. Unit 6 ¼″ W, 6 ¼″ H (160 x 160mm). Rough Wall Opening: 5 ½″ W, 5 ½″ H, 4″ min. depth (140 x 140 x 100mm). Universal/Barrier-Free Mtg. Ht.: 22 ⅛″ (560mm) to top of unit.

B-6637 Similar to B-663, but with satin finish.

Theft-resistant Spindle (Part No. 283-604) available as an option for above models, see page 26.

B-386 PARTITION-MOUNTED MULTI–ROLL TOILET TISSUE DISPENSER (SERVES 2 COMPARTMENTS)

Satin-finish stainless steel. Mounts centered through toilet partitions, ½–2″ (12–50mm) thick; used from both sides. Holds four standard core toilet tissue rolls up to 5 ⅛″ (130mm) diameter; two for each side. Chrome-plated plastic spindles with heavy-duty internal springs. Rough Partition Opening: 11 ½″ W, 10 ⅞″ H (290 x 275mm). Av. Mtg. Ht.: 36″ (915mm) to top of unit; Barrier-Free Mtg. Ht.: 27 ½″ (700mm). Theft-Resistant Spindle (Part No. 283-604) available as an option for above model, see page 26.



B-667 **B-697** **B-699**

600 SERIES RECESSED TOILET TISSUE DISPENSERS

Type 304 stainless steel with one-piece seamless construction. • Choice of finish: bright-polished or satin. • Chrome-plated plastic spindles hold rolls up to 5 ⅛″ (130mm) diameter (1500 sheets). • Choice of capacity: single-roll models measure 6 ⅛″ W x 6 ⅛″ H (155 x 155mm); double-roll models measure 12 5⁄16″ W x 6 ⅛″ H (315 x 155mm).• Mounting: clamps for securing to stud walls or countertop aprons.• Rough Wall Openings: single-roll models require 5 ½″ W x 5 ¼″ H x 3 ⅜″ min. depth (140 x 135 x 85mm), double-roll models require 11 ¾″ W x 5 ¼″ H x 3 ⅜″ min. depth (300 x 135 x 85mm).

*MODEL NO.	CAPACITY 1 ROLL	CAPACITY 2 ROLLS	FINISH BRIGHT	FINISH SATIN	STAINLESS STEEL HOODS
B-667	√		√		
B-6677	√			√	
B-669	√		√		√
B-6697	√			√	√
B-697		√	√		
B-6977		√		√	
B-699		√	√		√
B-6997		√		√	√

*Theft-Resistant Spindle (Part No. 283-604), option for all models, pg. 26.

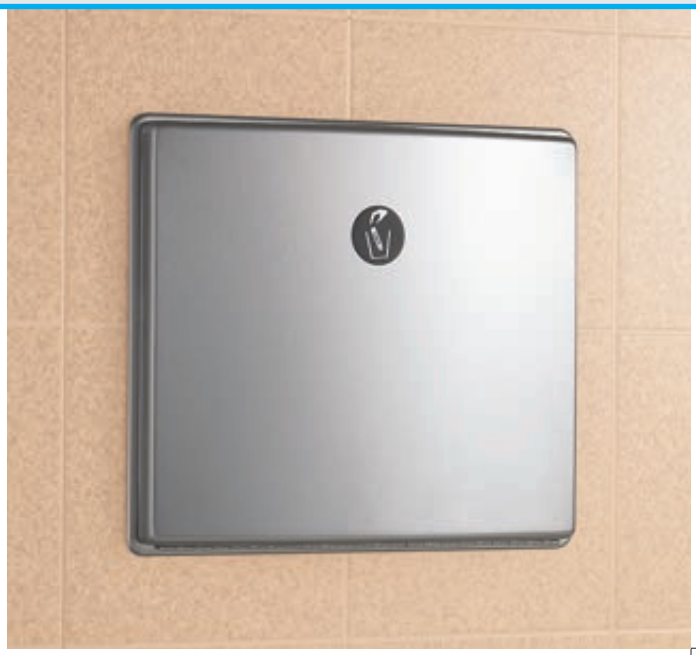
B-4288 ConturaSeries SURFACE-MOUNTED MULTI-ROLL TOILET TISSUE DISPENSER

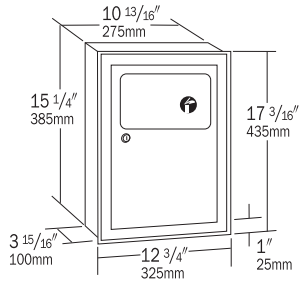
Satin-finish stainless steel unit with stainless steel dispensing mechanism. Flush tumbler lock. Holds two rolls up to 5 ¼″ (135mm) diameter (1800 sheets). Extra roll automatically drops in place when bottom roll is depleted. Theft-resistant, heavy-duty spindles. Unit 6 1⁄16″ W, 11″ H, 5 15⁄16″ D (155 x 280 x 150mm). Av. Mtg. Ht.: 28–36″ (710–915mm) to top of unit; Barrier-Free, 28″ (710mm).

B-2888 ClassicSeries SURFACE-MOUNTED MULTI-ROLL TOILET TISSUE DISPENSER

Satin-finish stainless steel unit with stainless steel dispensing mechanism. Door has flat face with protruding tumbler lock. Holds two rolls up to 5 ¼″ (135mm) diameter (1800 sheets). Extra roll automatically drops in place when bottom roll is depleted. Theft-resistant, heavy-duty spindles. Unit 6 1⁄16″ W, 11″ H, 5 15⁄16″ D (155 x 280 x 150mm). Av. Mtg. Ht.: 28–36″ (710–915mm) to top of unit; Barrier-Free, 28″ (710mm).

USA & Canada QuickShip model. USA QuickShip model.

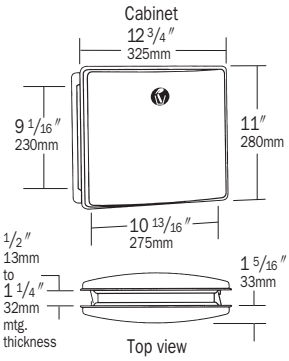




⚡B-353 ClassicSeries RECESSED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Seamless beveled flange. Door has tumbler lock. Self-closing panel covers disposal opening. Removable, leak-proof, 1.2-gal. (4.6-L) plastic receptacle. Rough Wall Opening: 11 ¼″ W, 15 ⅝″ H, 4″ min. depth (285 x 395 x 100mm). Universal/Barrier-Free Mtg. Ht.: 31″ (785mm) to top of unit.

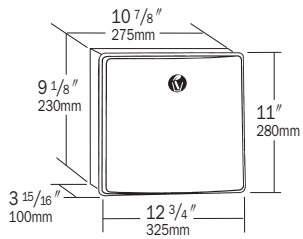
353-12 Disposable paper liners. 1,000 per case.



B-4354 ConturaSeries PARTITION MOUNTED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Mounts in toilet partition ½–1 ¼″ (13–32mm) thick. Self-closing doors pull down with less than 5 lbs of force (22.2 N) for access to disposal. Removable, leak-proof, 0.7-gal. (2.7-L) plastic receptacle. Rough Partition Opening: 11″ W, 9 ⅜″ H (280 x 240mm). Universal/Barrier-Free Mtg. Ht.: 31″ (785mm) to top of unit. Patented.

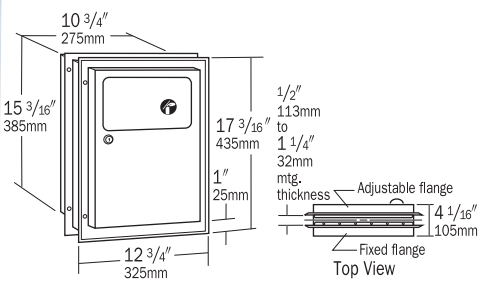
353-12 Disposable paper liners. 1,000 per case.



B-4353 ConturaSeries RECESSED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Self-closing door pulls down for access to disposal. Furnished with removable, leak-proof, 1.2-gal. (4.6-L) plastic receptacle. Rough Wall Opening: 11 ¼″ W, 9 ½″ H, 4″ min. depth (285 x 240 x 100mm). Universal/Barrier-Free Mtg. Ht.: 31″ (785mm) to top of unit.

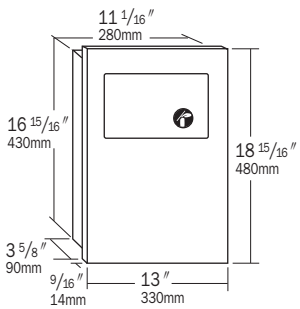
353-12 Disposable paper liners. 1,000 per case.



⚡B-354 ClassicSeries PARTITION MOUNTED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Mounts in partitions ½–1 ¼″ (13–32mm) thick. Self-closing panels cover openings. Removable, leakproof, 1.2-gal. (4.6-L) plastic receptacle. Rough Partition Opening: 11″ W, 15 ½″ H (280 x 395mm). Universal/Barrier-Free Mtg. Ht.: 31″ (785mm) to top of unit.

353-12 Disposable paper liners. 1,000 per case.

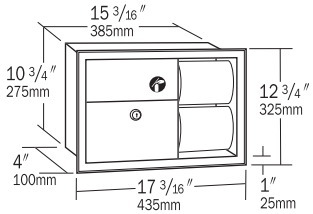


B-35303 TrimLineSeries RECESSED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Door has 90° return, conceals flange. Self-closing panel covers disposal opening. Removable, leak-proof, 1.2-gal. (4.6-L) plastic receptacle. Rough Wall Opening: 11 ½″ W, 17 ¼″ H, 3 ¾″ min. depth (290 x 440 x 95mm). Universal/Barrier-Free Mtg. Ht.: 31″ (785mm) to top of unit.

353-12 Disposable paper liners. 1,000 per case.

⚡ USA & Canada QuickShip model. ⚡ USA QuickShip model.



B-3094 ClassicSeries RECESSED SANITARY NAPKIN DISPOSAL AND TOILET TISSUE DISPENSER

Satin-finish stainless steel. Disposal door is self-closing. Receptacle retained in cabinet by tumbler lock. Capacity: ¾-gal. (2.8-L). Holds two rolls up to 5 ¼″ (135mm) diameter (1800 sheets). Rough Wall Opening: 15 ⅝″ W, 11 ¼″ H, 4″ min. depth (395 x 285 x 100mm). Universal/ Barrier-Free Mtg. Ht.: 30″ (760mm) to top of unit.

Theft-Resistant Spindle (Part No. 283-604) available as an option for above model, see page 26.

B-254 ClassicSeries SURFACE-MOUNTED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Door has tumbler lock. Self-closing panel covers disposal opening. Removable, leak-proof, 1.2-gal. (4.6-L) plastic receptacle. Unit 10 $^{11}/_{16}$″ W, 15 ⅛″ H, 4 $^{1}/_{16}$″ D (270 x 385 x 105mm). Universal/Barrier-Free Mtg. Ht.: 30″ (760mm) to top of unit.

353-12 Disposable paper liners. 1,000 per case.

B-270 ConturaSeries SURFACE MOUNTED SANITARY NAPKIN DISPOSAL

Satin-finish stainless steel. Cover is drawn, one-piece construction; secured to cabinet with full-length stainless steel piano-hinge. Capacity: 1.0-gal. (3.8-L). Unit 7 ½″ W, 10″ H, 3 $^{13}/_{16}$″ D (190 x 255 x 95mm). Universal/Barrier-Free Mtg. Ht.: 25–30″ (635–760mm) to top of unit.

270-12 Disposable paper liners. 1,000 per case.

B-5270 MatrixSeries SURFACE-MOUNTED SANITARY NAPKIN DISPOSAL

Durable ABS plastic; grey color. Lid features fingertip handles for easy access. Capacity: 1.3-gal. (4.8-L). Unit 9 ¼″ W, 11 ⅜″ H, 3 ⅞″ D (235 x 290 x 100mm). Universal/ Barrier-Free Mtg. Ht.: 25–30″ (635–760mm) to top of unit. Patented.

270-12 Disposable paper liners. 1,000 per case.

Cubicle Collection

B-541 SPARE TOILET ROLL HOLDER See page 25.

B-542 COAT HOOK See page 35.

B-543 SINGLE ROLL TOILET TISSUE DISPENSER See page 25.

B-544 TOILET BRUSH HOLDER See page 36.

CONFIGURATIONS, DIMENSIONS, FINISHES:

1 ½" (38MM) DIA. STRAIGHT/SATIN

B-6806x12" (305mm)
B-6806x18" (455mm)
B-6806x24" (610mm)
B-6806x30" (760mm)
B-6806x36" (915mm)
B-6806x42" (1065mm)
B-6806x48" (1220mm)

1 ¼" (32MM) DIA. STRAIGHT/SATIN

B-5806x18" (455mm)
B-5806x24" (610mm
B-5806x30" (760mm)
B-5806x36" (915mm)
B-5806x42" (1065mm)
B-5806x48" (1220mm)

1 ½" (38MM) DIA. STRAIGHT/PEENED

B-6806.99x18" (455mm)
B-6806.99x24" (610mm)
B-6806.99x30" (760mm)
B-6806.99x36" (915mm)
B-6806.99x42" (1065mm)

1 ¼" (32MM) DIA. STRAIGHT/PEENED

B-5806.99x18" (455mm)
B-5806.99x24" (610mm)
B-5806.99x30" (760mm)
B-5806.99x36" (915mm)
B-5806.99x42" (1065mm)

CONCEALED MOUNTING WITH SNAP FLANGE

- Constructed of 18-gauge (1.2mm), type 304 satin-finish stainless steel tubing in 1 ¼″ and 1 ½″ (32 and 38mm) diameters.
- Concealed mounting flange ⅛″ (3mm) thick, type 304 stainless steel plate, 2″ W x 3 ⅛″ H (50 x 80mm), with screw holes for concealed anchors.
- Cover is 22-gauge (0.8mm), type 304 stainless steel with satin finish, 3 ¼″ (85mm) diameter.
- Cover snaps over mounting flange to conceal screws.
- Peened nonslip gripping surface available.

SERIES	DIAMETER	FINISH*
B-6806*	1 ½″ (38mm)	Satin Finish
B-5806*	1 ¼″ (32mm)	Satin Finish

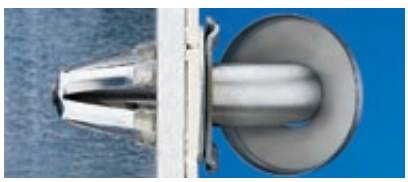
*Peened nonslip gripping surface available. Add suffix .99 to model number.

OPTIONAL MOUNTING KITS

Order one per flange. Part No. **252-30** (3) sheet-metal screws; **2521-30** (3) machine screws with toggle nuts; **2522-30** (3) machine screws with expansion shields.

OPTIONAL ANCHOR DEVICES

Order one per flange. Part No. **2583** anchors for ¾″ to 1″ (19–25mm) panels; **2586** anchors for ½″ (13mm) panels.



251-4 WingIt™ GRAB BAR FASTENER

For 2 ½″ and 3 ½″ (65 and 90mm) or deeper hollow walls with finished wall surfaces ¼″ to 1 ½″ (6 to 38mm) thick. One fastener required for each flange. Corrosion-resistant stainless steel. Install grab bars without backing. The fastener will support 300 lbs (136 kg) load. Patented.

WingIt™ is a trademark of WingIt Innovations, LLC.

TWO-WALL TUB/ SHOWER TOILET COMPT.

24″ W x 36″ D (61 x 91cm)
1 ½″ (38mm) Dia.
B-68616 Satin
B-68616.99 Peened
1 ¼″ (32mm) Dia.
B-58616 Satin
B-58616.99 Peened

TWO-WALL TUB/ SHOWER TOILET COMPT.

36″ W x 54″ D (91 x 137cm)
1 ½″ (38mm) Dia.
B-68137 Satin
B-68137.99 Peened
1 ¼″ (32mm) Dia.
B-5837 Satin
B-5837.99 Peened

TWO-WALL SHOWER

15 ⅞″ W x 30 ⅞″ D (40 x 78cm)
1 ½″ (38mm) Dia.
B-6861 Satin
B-6861.99 Peened

TWO-WALL TOILET COMPT.

42″ W x 54″ D (107 x 137 cm)
1 ½″ (38mm) Dia.
B-6897 Satin
B-6897.99 Peened
1 ¼″ (32mm) Dia.
B-5897 Satin
B-5897.99 Peened

SWING UP

29″ (74cm) Patented
1 ¼″ (32mm) Dia.
B-4998 Satin
B-4998.99 Peened

GAMCO

SPECIAL GAMCO GRAB BARS WITHOUT THE SPECIAL ORDER

- Customized configurations and dimensions.
- Runs of one to thousands.
- Brass and bronze metallic finishes.
- Electrostatic precise color matching.

B-680 SURFACE-MOUNTED SOAP DISH

Bright-polished stainless steel. Drawn, one-piece soap dish welded to support arm and flange. Two ridges hold soap; two drain holes. Unit 4 ¼″ W, 2″ H (110 x 50mm); projects 3 ⅜″ (85mm) from wall.

B-6807 Similar to B-680, but with satin finish.

B-673 SURFACE-MOUNTED TOWEL BAR

Bright-polished stainless steel. ¾″ (19mm) square towel bar. Available in 18″ and 24″ lengths (455, 610mm). Projects 3 ¼″ (85mm) from wall.

B-6737 Similar to B-673, but with satin finish. 24″ length (610mm).

B-687 SURFACE-MOUNTED DOOR BUMPER

Bright-polished stainless steel. Flange is 2″ x 2″ (50 x 50mm). Black nylon post with black neoprene bumper. Projects 2 ⅛″ (55mm) from wall.

B-674 SURFACE-MOUNTED TOWEL BAR

Bright-polished stainless steel. Round ¾″ (19mm) diameter towel bar. Available in 18″ and 24″ lengths (455, 610mm). Projects 3 ¼″ (85mm).

B-6747 Similar to B-674, but with satin finish. 24″ length (610mm).

B-683 SURFACE-MOUNTED TOILETRY SHELF

Bright-polished stainless steel. 24″ length (610mm). Shelf 4 ¾″ (120mm) wide, projects 5 ¾″ (145mm) from wall. Edges are roll-formed for safety.

B-530 EXTRA-HEAVY-DUTY SURFACE-MOUNTED TOWEL BAR

For use in hospital and hotel bathrooms. 1″ (25mm) diameter bar is 18-gauge (1.2mm), type 304 stainless steel, satin finish. mounting with snap flange. Withstands 900 lbs (408 kg) downward pull when properly installed. Available in 18″ and 24″ lengths (455, 610mm).

B-676 SURFACE-MOUNTED TOWEL SHELF WITH TOWEL BAR

Bright-polished stainless steel. Shelf 6 ¼″ (160mm) wide, consists of four 5⁄16″ (8mm) square tubes. 5⁄16″ (8mm) square towel bar below shelf. 24″ length (610mm). Projects 8 ½″ (215mm) from wall.

B-8397 SURFACE-MOUNTED 100-FACIAL TISSUE DISPENSER

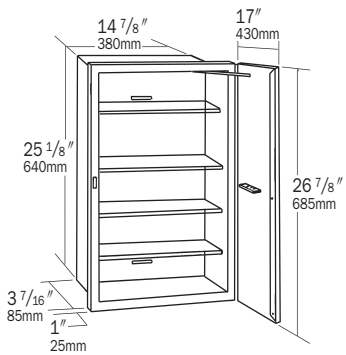
Dispenses one pack of 100 two-ply facial tissues. Cabinet type 304 stainless steel, satin finish. Equipped with concealed locking device; opens with key provided. Concealed wall plate is 22-gauge (0.8mm), type 304 stainless steel. Unit 10 ¼″ W, 5 3⁄16″ H, 2 ¼″ D (260 x 130 x 55mm).

USA & Canada QuickShip model. USA QuickShip model.

2 ½″ (65mm) Square Flange
for B-6047 and B-6107

⚡B-6047 ClassicSeries EXTRA HEAVY-DUTY SHOWER CURTAIN ROD
Type 304 stainless steel, satin finish. 18-gauge (1.2mm), 1 ¼″ (32mm) diameter rod. Flanges are 2 ½″ (65mm) square. Available in 36″ (915mm), 48″ (1220mm), ⚡60″ (1525mm), 72″ (1830mm) lengths.

⚡B-6107 ClassicSeries HEAVY-DUTY SHOWER CURTAIN ROD Similar to B-6047, but with 20-gauge (1.0mm), 1″ (25mm) diameter rod. Available in ⚡36″ (915mm), 48″ (1220mm), ⚡60″ (1525mm), 72″ (1830mm) lengths.



B-398

Unit combines adjustable shelves, mirror, used razor blade slot, and toothbrush holder.

B-398 RECESSED MEDICINE CABINET
Type 304 stainless steel, satin finish. Mirror: No. 1 quality, ¼″ (6mm) glass electrolytically copper-plated. 15-year guarantee against silver spoilage. Door has full-length stainless steel piano-hinge, magnetic catch and cable doorstop. Four adjustable stainless steel shelves. Cabinet may be inverted for right- or left-hand door swing. Rough Wall Opening: 15 ¼″ W, 25 ½″ H, 3 ⅝″ min. depth (385 x 650 x 90mm). Av. Mtg. Ht.: 74″ (1880mm) to top of unit; Barrier-Free, 66 ½″ (1690mm).

B-299 Surface-Mounted Medicine Cabinet Similar to B-398. Unit 17″ W, 26 ⅞″ H, 5″ D (430 x 685 x 130mm).

⚡B-397 RECESSED MEDICINE CABINET
All-steel cabinet with baked white enamel finish. Three adjustable plastic shelves. Mirror: No. 1 quality, ¼″ (6mm) glass electrolytically copper-plated. Door has enameled steel piano-hinge and magnetic catch. Door is 15 ½″ W, 25 ⅞″ H (405 x 655mm). Rough Wall Opening: 14″ W, 23 ⅝″ H, 3 ½″ min. depth (355 x 600 x 90mm) Av. Mtg. Ht.: 73″ (1855mm) to top of unit; Barrier-Free, 65 ½″ (1665mm).

B-297 SURFACE-MOUNTED MEDICINE CABINET
All-steel cabinet and two fixed shelves with baked white enamel finish. Mirror: No. 1 quality, ⅛″ (3mm) glass electrolytically copper-plated. Door has enameled steel piano-hinge and magnetic catch. Door is 14 ⅛″ W, 20 ¼″ H (360 x 515mm). Unit 3 ¾″ (95mm) deep. Av. Mtg. Ht.: 69″ (1755mm) to top of unit; Barrier-Free, 60″ (1525mm).

⚡B-207 SHOWER CURTAIN ROD WITH CONCEALED MOUNTING
1″ (25mm) diameter rod is 20-gauge (1.0mm), type 304 stainless steel, satin finish. 1 ⅜″ (35mm) diameter flanges are chrome-plated plastic, bright-polished finish; mount on concealed wall brackets. Available in 36″ (915mm), 48″ (1220mm), ⚡60″ (1525mm), 72″ (1830mm) lengths.

⚡204-2 VINYL SHOWER CURTAIN
Opaque, matte white vinyl, 0.008″ (0.2mm) thick, contains anti-bacterial and flame-retardant agents. Nickel-plated brass grommets along top, one every 6″ (150mm). Bottom and sides are hemmed. Hooks are not included. Curtain 42″ W, 72″ H (1065 x 1830mm). Requires 7 hooks.

⚡204-3 Similar to 204-2, but curtain is 70″ W, 72″ H (1780 x 1830mm). Requires 12 hooks.

⚡204-1 SHOWER CURTAIN HOOK Type 304 stainless steel for use on 1″ and 1 ¼″ (25 and 32mm) diameter shower curtain rods.

B-4390 RECESSED HEAVY-DUTY SOAP DISH AND BAR

Type 304 stainless steel, matte polished finish. Mounting clamp for stud walls. Unit 7 3⁄16″ W, 5″ H (185 x 125mm). Rough Wall Opening: 6″ W, 4″ H, 4″ min. depth (150 x 100 x 100mm). Barrier-Free Mtg. Ht.: 38–48″ (965–1220mm) above the finish floor on same wall as shower head.

B-4380 Similar to B-4390, but without bar.

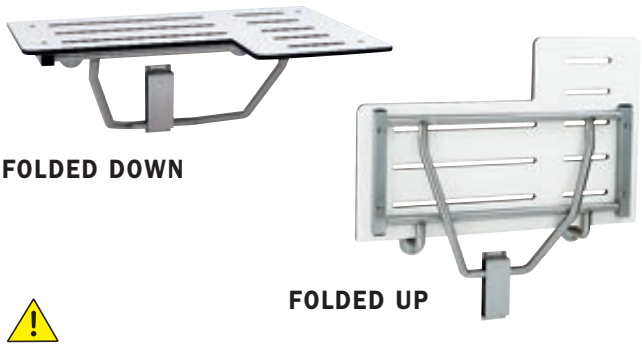
B-518 FOLDING SHOWER SEAT

Complies with ADA Barrier-Free Accessibility Guidelines. Foam-padded, white, water-resistant Naugahyde seat 1 ½″ (38mm) thick, with enclosed ½″ (13mm) plywood base. Frame and mounting brackets are type 304 stainless steel and feature self-locking mechanism. Supports up to 360 lbs (163 kg) when properly installed. Seat 32 7⁄8″ (835mm) wide, projects 22 11⁄16″ (575mm) from wall. Universal/Barrier-Free Mtg. Ht.: 17–19″ (430–485mm) from top of seat to floor. Left-hand seat.

B-517 Similar to B-518, but with right-hand seat.

⚡B-5191 FOLDING SHOWER/DRESSING AREA SEAT

Compact design. Seat is constructed of durable, water-resistant, ivory-colored, 5⁄16″ (8mm) thick solid phenolic. Frame and mounting bracket are type 304 stainless steel and feature self-locking mechanism. Supports up to 450 lbs (204 kg) when properly installed. Seat 18″ (455mm) wide, projects 15 13⁄16″ (400mm) from wall. Universal/Barrier-Free Mtg. Ht.: 17–19″ (430–485mm) from top of seat to floor.



⚡B-5181 REVERSIBLE FOLDING SHOWER SEAT

Complies with ADA Barrier-Free Accessibility Guidelines. Seat is constructed of durable, water-resistant, ivory-colored ½″ (13mm) thick solid phenolic. Reversible for left- or right-hand field installation. Frame and mounting brackets are type 304 stainless steel with self-locking mechanism. Supports up to 360 lbs (163 kg) when properly installed. Seat 33″ (840mm) wide, projects 22 5⁄16″ (565mm) from wall. Universal/Barrier-Free Mtg. Ht.:17–19″ (430–485mm) from top of seat to floor. Left-hand seat shown.

CAUTION NOTE

Rectangular Folding Shower Seat: B-5191
Rectangular folding shower seat, when properly installed and maintained, has sufficient strength to support a single user up to a maximum static load of 450 lbs (204 kg). In the interests of safety and the protection of end users, this seat should not be used to support weights exceeding 450 lbs (204 kg). Failure to abide by this warning may result in seat malfunctioning, potentially causing minor to moderate injury.
TOTAL WEIGHT ON SEAT MUST NOT EXCEED 450 LBS (204 KG).

CAUTION NOTE

L-shaped Folding Shower Seats: B-517, B-518, B-5181
L-shaped folding shower seats, when properly installed and maintained, have sufficient strength to support a single user up to a maximum static load of 360 lbs (163 kg). In the interests of safety and the protection of end users, these seats should not be used to support weights exceeding 360 lbs (163 kg) . Failure to abide by this warning may result in seats malfunctioning, potentially causing minor to moderate injury.
TOTAL WEIGHT ON SEAT MUST NOT EXCEED 360 LBS (163 KG).

DESIGNER'S NOTE:

Solid phenolic seats available in other colors on special order. See Bobrick Solid Phenolic Color Guide.

⚡ USA & Canada QuickShip model. ⚡ USA QuickShip model.

B-670 UTILITY HOOK
Bright-polished stainless steel. For robes, shoe-shine cloth, and sanitary napkin disposal bag. Flange is 2″ x 2″ (50 x 50mm). Hook ½″ (13mm) wide, projects 2″ (50mm) from wall.

B-6707 Similar to B-670, but with satin finish.

B-677 TOWEL PIN
Bright-polished stainless steel. Flange is 2″ x 2″ (50 x 50mm). Projects 3 ⅜″ (85mm) from wall.

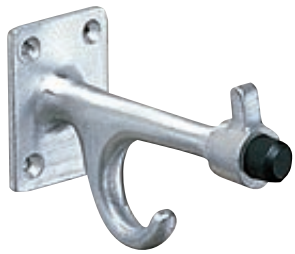
B-6777 Similar to B-677, but with satin finish.

B-671 SINGLE ROBE HOOK
Bright-polished satin finish. Flange is 2″ x 2″ (50 x 50mm). Hook is 1 ¼″ high, 1 ¼″ wide (30 x 30mm). Projects 2″ (50mm) from wall.

B-6717 Similar to B-671, but with satin finish.

B-7671 SINGLE ROBE HOOK Similar to B-671, but hook is 1 ⅝″ high, 13⁄16″ wide (40 x 20mm). Projects 1 ⅝″ (40mm) from wall.

B-76717 Similar to B-7671, but with satin finish.



B-212 CLOTHES HOOK AND BUMPER
Solid aluminum casting, matte finish. Rubber bumper protects wall or partition surfaces.

B-672 DOUBLE ROBE HOOK
Satin-finish stainless steel. Contoured 4″ (100mm) wide bar forms hook at each end. Flange is 2″ x 2″ (50 x 50mm). Projects 2 5⁄16″ (60mm) from wall.

B-6727 Similar to B-672, but with satin finish.

B-7672 DOUBLE ROBE HOOK Similar to B-672, but contoured hook is 3 15⁄16″ (100mm) wide. Projects 1 ⅞″ (50mm) from wall.

B-76727 Similar to B-7672, but with satin finish.

B-233 CLOTHES HOOK
11-gauge (3.2mm), type 304 stainless steel, satin finish. Hook is 1 ¼″ x 1 ¼″ (30 x 30mm) and projects 1 ⅛″ (30mm) from wall. Unit is 2 ¼″ (55mm) high.

NEW

B-542 Cubicle Collection COAT HOOK
Satin-finish stainless steel. Threaded flange conceals mounting plate, provides snug fit to the wall. Flange has 1 15⁄16″ (50mm) diameter. Hook is ½″ (13mm) high. Projects 1 5⁄16″ (35mm).

See page 29 for the complete Cubicle Collection.

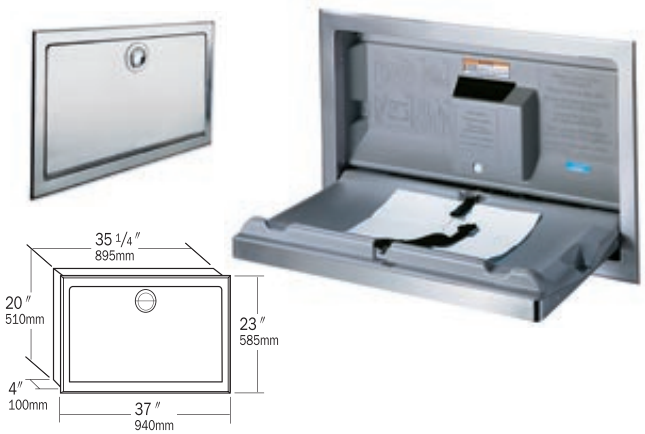
Customers have the option of ordering Koala products and colors listed on page 38 from Bobrick or Koala. Products on page 39 are ordered through Koala only.

Please, one baby at time. The three babies shown are to dramatize the strength of the KB200.

NEW

⚡KB200-00 HORIZONTAL, WALL-MOUNTED

Cream-color polypropylene cabinet and bed. Unit 35″ W x 22″ H (890 x 560mm). Depth (closed) 4″ (100mm). Extension (open) 22 ½″ (570mm). Patented. Available from Bobrick in cream-color only.



KB110-SSRE HORIZONTAL, RECESSED MOUNTED

18-gauge, type 304 satin stainless steel exterior finish with molded grey color polyethylene interior. Unit 37″ W x 23″ H (940 x 585mm). Depth (closed) ¾″ (20mm). Extension (open) 15 ¼″ (385mm). Rough Wall Opening: 35 ½″ W x 20 ½″ H (900 x 520mm), 4″ (100mm) min. depth.

KB110-SSWM HORIZONTAL, WALL-MOUNTED

18-gauge, type 304 satin stainless steel exterior finish with molded grey color polyethylene interior. Unit 35 ¼″ W, 20″ H (890 x 510mm). Depth (closed) 4″ (100mm). Extension (open) 15 3⁄16″ (385mm).

⚡KB101-00 VERTICAL, WALL-MOUNTED

Cream-color polyethylene cabinet and bed. Unit 22″ W x 35 ½″ H (560 x 900mm). Depth (closed) 5 ¼″ (135mm). Extension (open) 35″ (890mm). Available from Bobrick in cream-color only.

KB102-00 CHILD PROTECTION SEAT, WALL-MOUNTED

Cream-color polyethylene seat and back. Unit 12 ¼″ W x 18 ¾″ H (310 x 475mm). Depth (closed) 5 ⅝″ (145mm). Extension (open) 12 ½″ (315mm). Available from Bobrick in cream-color only.

⚡ USA & Canada QuickShip model.

www.koalabear.com
(888) 733-3456

Koala Kare
We Care for Kids.

Customers have the option of ordering Koala products and colors listed on page 38 from Bobrick or Koala. Products on page 39 are ordered through Koala only. For copies of Koala's full line Baby Changing Station Catalog, or for the name of your Bobrick-Koala Representative, please visit us on-line or telephone toll-free.

NEW

KB200 HORIZONTAL, WALL-MOUNTED

All colors available from Koala Kare: add suffix number: Cream (-00), Grey (-01), White Granite (-05) and Earth (-11). Patented.

KB100-ST HORIZONTAL, RECESSED-MOUNTED WITH STAINLESS STEEL FLANGE

See Koala catalog for complete product data.

KB112-01RE RECESSED COUNTERTOP-MOUNTED
KB112-01CT COUNTERTOP SURFACE-MOUNTED

See Koala catalog for complete product data. Patented.

KB111-SSRE VERTICAL, SEMI-RECESSED MOUNTED
KB111-SSWM VERTICAL, WALL-MOUNTED

See Koala catalog for complete product data.

KB101 VERTICAL, WALL-MOUNTED

All colors available from Koala Kare: add suffix number: Cream (-00), Grey (-01) and White Granite (-05).

KB150-99 SANITARY BED LINERS

See Koala catalog for complete product data.

KB102-00 CHILD PROTECTION SEAT, WALL-MOUNTED

All colors available from Koala Kare: add suffix number: Cream (-00), Grey (-01).

DESIGNER'S NOTES:

1. Full-length steel-on-steel hinges with 11-gauge steel mounting supports. 2. Complies with ANSI S117.1 Accessible and Usable Buildings and Facilities, ASTM F2285-04 (formerly ASTM PS125) Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use, ANSI Z535.4 Product Safety Signs and Labels, ASTM G21 Antifungal and ASTM G22 Antibacterial Standards, EN 12221-1/-2 European Standards (KB200 only), ADA Accessibility Standards for height, reach, projection, operation, overlap wheelchair turning radius when properly installed. 3. Constructed of high-density polyethylene (KB200 is constructed of polypropylene) with exclusive Microban antimicrobial product protection. 4. Replaceable nylon safety straps, hooks for bags and purses. 5. All Baby Changing Station models equipped with built-in Sanitary Bed Liner Dispensers.

MICROBAN® ANTIMICROBIAL PRODUCT PROTECTION: A KOALA BABY CHANGING STATION EXCLUSIVE.

Microban technology is built into all Koala Baby Changing Stations and becomes an intrinsic part of the Station. When microbes, such as bacteria, mold and mildew that can cause stains, odors and product deterioration come into contact with the station surface, Microban protection penetrates the cell wall of the microbe and disrupts key cell functions so that the microbe cannot function, grow or reproduce. See Technical Bulletin, TB-12.

Company Directory

BOBRICK WASHROOM EQUIPMENT, INC.

LOS ANGELES: 11611 Hart Street
North Hollywood, California 91605-5882
Washroom Accessories: (818) 982-9600; FAX: (818) 503-1102
e-mail: customerservicela@bobrick.com
Toilet Partitions: (818) 982-9070; FAX: (818) 503-9287
e-mail: lacspartitions@bobrick.com

JACKSON, TN: 100 Bobrick Drive
Jackson, TN 38301-5625
(731) 424-7000; FAX: (731) 424-7800

NEW YORK: 200 Commerce Drive
Clifton Park, NY 12065-1350
(518) 877-7444; FAX: (518) 877-5029
e-mail: customerserviceny@bobrick.com

CANADA: BOBRICK WASHROOM EQUIPMENT COMPANY
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Ontario East: (877) 423-6555, FAX: (877) 423-8555
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Manitoba West: (877) 423-6444, FAX: (877) 423-8444
e-mail: customerservicewca@Bobrick.com

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e-mail: international@bobrick.com

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e-mail: international@bobrick.com

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0800 79 00 456; FAX: 0800 79 00 789
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+44 (0)20 8366 1771; FAX: +44 (0)20 8363 5794
e-mail: uksales@bobrick.com

WWW.BOBRICK.COM

GAMCO COMMERCIAL RESTROOM ACCESSORIES
A Division of Bobrick
One Gamco Place
Durant, OK 74701-1910
(800) 451-5766; FAX: (580) 920-2050
e-mail: mail@gamcousa.com
WWW.GAMCOUSA.COM

KOALA KARE PRODUCTS
A Division of Bobrick
6982 S. Quentin St.
Centennial, CO 80112-3945
(888) 733-3456; FAX: (303) 539-8399
e-mail: customerservice@koalabear.com
WWW.KOALABEAR.COM

Illustrations and descriptions herein are applicable to production as of the date of this catalog. The manufacturer reserves the right and does from time to time make changes and improvements in designs and dimensions. Catalog No. P-1006, 100M. September 30, 2010.

Product Warranties

The following Bobrick products are warranted to be free from defects in workmanship and material under normal usage from the date of purchase for the periods set forth below. (Rust and discoloration to stainless steel parts resulting from exposure to harsh environmental and/or chemical conditions are not considered to be defects in workmanship or material and there is no express or implied warranty for such condition. Refer to Bobrick Bulletin TB-21, Effective Ways to Clean Stainless Steel):

Washroom Accessories/Soap Dispensers	Limited Warranty
ConturaSeries Washroom Accessories	3 years
Soap Dispensers B-306, B-4063, B-4112, B-822 Series, B-826, B-8263	3 years
B-830 SureFlo Soap System Soap Pumps	Lifetime warranty provided Bobrick SureFlo Soap is used exclusively with this product

The following Bobrick mirrors are warranted against silver spoilage from the date of purchase for the periods set forth below:

Mirrors	Limited Warranty
B-290, B-2908, B-292, B-293, B-294 Series B-165, B-1658, B-166 Series	15 years

The following Bobrick hand dryers are warranted to be free from defects in workmanship and material under normal usage from the date of purchase for the periods set forth below:

Hand Dryers	Limited Warranty
B-700, B-7120, B-7128 B-750 AirCraft B-740, B-748 Eclipse B-708 AirGuard	Motor brushes for 3 years; all other parts for 10 years
B-710 Compac	1 year

Koala Kare products are backed by a 5-year limited liability warranty to be free of defects in workmanship and material, and a 5-year replacement policy against vandalism.

OTHER PRODUCTS:

Bobrick washroom accessories not listed above are warranted to be free from defects in workmanship and material under normal usage service for one year from the date of purchase.

LIMITATIONS ON WARRANTIES:

In all instances, the purchaser's exclusive remedy against Bobrick is for the repair or replacement, at Bobrick's option, of warranted defective products or parts. Bobrick will also bear the cost of the purchaser's return of defective products or parts to Bobrick. Bobrick's warranties set forth above do not cover damage resulting from vandalism. No other remedy (including, but not limited to, damages for field labor charges, lost profits, lost sales, injury to persons or property or any other incidental or consequential losses) is available.

PATENTS:

The Bobrick products shown in this catalog with the notation "Patented" are protected under one or more of the following Patent Numbers:
Canada: 2342510, 2336013, 2311345, 2309470, 2220402, 91501; **United States:** 7469779, 6502721, 6276027, 6131771, 6129245, 6119901, 6032819, 5988451, 5987677, 5871113, 5476197, 5377908, 5261619, 5226625, D605866, D601843, D426412, D425253, D420764, D416726, D415857, D413419, D401708, D401093, D388578, D387590, D387229, D386027, D385445. Other patents pending.

Components of Models B-2974, B-29744, B-3974, B-39747, B-3979, 3974-50 and B-72974 are covered by patent numbers owned by our supplier: **Canada:** 2572341, 2533000, 2489669; **United States:** 7594622, 7296765, 7084592, 7040566.

Components of Models B-3961, B-39617, B-39619, B-72860 and B-2860 are covered by patent numbers owned by our supplier: **Canada:** 2439918; **United States:** 6553879, 6314850.

Components of Part No. 251-4 are covered by patent numbers owned by our supplier: **Canada:** 2308182; **United States:** 6007285, 5944466.

BOBRICK

BUILDING VALUE SINCE 1906
BOBRICK.COM

FINALLY... A FAST HAND DRYER.

Zero To Dry In Less Than 15 Seconds.

Excel's research team has developed the **XLerator**™ with **patented technology** that delivers three-times-faster hand drying performance. Conventional hand dryers take from 30 to 45 seconds to get a user's hands totally dry, and very few of us are willing to wait that long. With **XLerator**, not only do your hands get dry in 10-15 seconds, but consumer test participants report that their hands also felt *warm*, *soft* and *really dry*.

3 Times Faster!

90% Cost Savings.

Converting to the **XLerator** hand dryer will result in more than a 90% savings vs. paper towel costs. In addition to paper towels, the following costs are also eliminated: ordering, storing, replenishing, collecting and disposing of bacteria-laden paper towel waste.

Saves Energy.

Not only does the **XLerator** dry hands in one third of the time required by conventional hand dryers, our hand-drying system is designed to run on 15-amp service (making it great for older buildings). The combination of these two factors results in **80% less** energy cost per use.

Source Reduction Alternative.

Converting from paper towels to the **XLerator** hand dryer is a great source reduction alternative. Make a cost-saving decision that's good for the environment because you don't sacrifice trees, incur the energy costs to turn pulp into paper and do away with the need to dispose of paper towel waste in already over-capacity landfills.

Promotes Hygiene.

People are increasingly concerned with the spread of germs these days, especially in public restrooms. The automatic sensor-activated **XLerator** hand dryer is a great addition to today's **no-touch** washrooms. The **XLerator** also speeds up the required hand-washing process for employees, getting them back on the job faster and with clean hands.

MADE IN USA

EXCEL

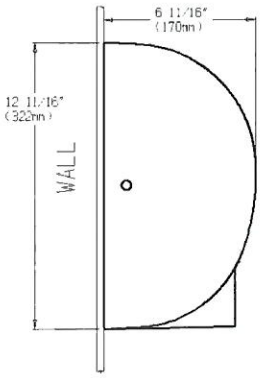
TIME TO THROW IN THE TOWEL.

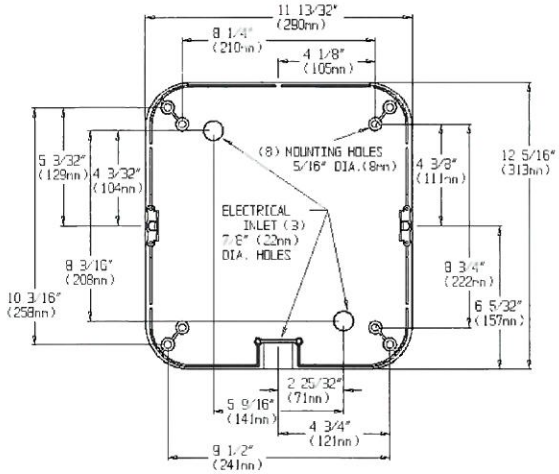
XLERATOR™ HAND DRYER

SPECIFICATIONS

MODEL XL-W Surface-mounted, Automatic, White epoxy Paint

MODEL XL-C Surface-mounted, Automatic, Chrome Plated





Units are Available as Specified in:		
110/120V	12.5 Amp	60 Hz
208V	7.5 Amp	60 Hz
220/240	6.5 Amp	60 Hz
277V	5.5 Amp	60 Hz
220/240V	6.5 Amp	50 Hz

Suggested Mounting Heights From floor to Bottom of Dryer	
Men's	43" (109 cm)
Ladies	41" (104 cm)
Teenagers	39" (99 cm)
Children	33" (84 cm)
Handicapped	35" (89 cm)

DIMENSIONS: 11 3/4" LG. X 12 11/16" HIGH X 6 11/16" DEEP
(298 MM LG. X 322 MM HIGH X 170 MM DEEP)
WEIGHT: 17 LBS. (7.7 KGS.)

CONSTRUCTION

A. Cover shall be a one-piece, heavy-duty, rib-reinforced, die-cast zinc alloy. It shall be lightweight, unbreakable, rustproof and all exposed surfaces shall be bright chrome plated or finished with chip-proof, electrostatically applied epoxy paint and fastened to a wall plate by two chrome plated tamper-proof bolts.

B. Wall plate shall be equipped with (3) 7/8" (22 mm) diameter holes, one of which shall be suitable for use with surface conduit, for ease of wiring.

C. All internal parts shall be coated according to Underwriters' Laboratories, Inc. requirements.

D. Entire mechanism shall be internally grounded.

MECHANISM

A. Motor shall be a series commutated through-flow discharge vacuum motor/blower (5/8 HP / 20,000 RPM) which provides air velocity of 16,000 LFM (linear feet per minute) at the air outlet and 14,000 LFM at the hands (4 inches [102 mm] below air outlet).

B. Heating element is constructed of Nichrome wire and mounted inside the blower housing, thereby being vandal proof. It shall be protected by an automatic resetting thermostat, which shall open whenever air flow is cut off and shall close when flow of air is resumed. It shall produce an air temperature of up to 135°F (57°C) at a 72°F (22°C) ambient room temperature at the hands (4 inches [102 mm] below air outlet).

C. Control assembly is activated by an infrared optical sensor located next to the air outlet. The dryer shall operate as long as hands are under the air outlet. There is a 35-second lockout feature if hands are not removed.

LIMITED WARRANTY

The dryer shall be guaranteed to be free from defects for a period of three (3) years. Warranty shall include factory performed labor as well as the repair or exchange of defective parts, at manufacturer's option.

QUANTITY RECOMMENDATIONS

One dryer for every two washbasins is sufficient for most applications. If restroom traffic is unusually heavy, we suggest one dryer per washbasin in small installations and two dryers for every three washbasins in larger installations. When a 54" washfountain is used, we suggest four to five dryers.

EXCEL DRYER Inc.
357 Chestnut Street • P.O. Box 365
East Longmeadow, MA 01028 U.S.A.
Tel: (413) 525-4531, Fax:(413) 525-2853
E-Mail: admin@exceldryer.com
www.exceldryer.com

Returned from:

RMA ID# 112607CB

☐ WARRANTY REPAIR

☒ NON-WARRANTY REPAIR

TO: EXCEL DRYER INC
P O BOX 365
357 CHESTNUT STREET
EAST LONGMEADOW, MA 01028

⇦ Attach this label to each box using clear packaging tape. Make sure RMA# is marked on label where indicated.

- AFFIX PROPER POSTAGE -

✂ Cut here and fold in half

Return Material Authorization

ID # 112607 CB

Fill out shipping information below and include inside box

Date Returned _____

Your Name: Jim Leo

Company Name: Cumberland County Civic Center

Street Address: 1 Civic Center Square

City Portland State ME Zip 04101

Daytime Phone: (207) 775-1188 Daytime Fax: (207) 775 4174

Please tell us why you are returning the item:

_____

_____

Please advise the following, even if item being returned is only part of a dryer:

Dryer Model No. XL-W 110-V

Dryer Serial No.. 188028

NOTE: If item returned is under warranty, we will repair & return, or replace (at our option) to the above address. Customer pays shipping costs when sending to Excel Dryer and Excel Dryer will pay shipping charges (excluding any brokerage fees, duties & taxes) when returning product to customer.

If this is a non-warranty return, we will evaluate the dryer/part and contact you with a price quotation prior to repairing. Customer is to pay all shipping costs. We accept all major credit cards as payment.

☐ WARRANTY REPAIR

☒ NON-WARRANTY REPAIR

For Return Department Use

- ☐ Special Instructions Apply See _____
- ☐ Priority
- ☐ Subject to Inspection
- ☐ Furnish details to _____
- ☐ Inspect/Return to stock

Excel Dryer, Inc
P. O. Box 365
East Longmeadow, MA 01028
Tel: 413-525-4531 Fax: 413-525-2853 e-mail: admin@exceldryer.com

Carol Breton 1-413 525 4531
cbreton@exceldryer.com

EXCEL DRYER Inc.
357 Chestnut Street • P.O. Box 365
East Longmeadow, MA 01028 (USA)
Tel (413) 525-4531 Fax (413) 525-2853
E-Mail: admin@exceldryer.com
® *Web:* www.exceldryer.com

1880 28
1880 18 ✓
19
20
21 ✓

DRYER PRICE LIST

effective May 1, 2001

(Subject to change without notice)

XLERATOR™ THREE TIMES FASTER hand drying power

439.20
120

HAND DRYERS:

XL - W	*Hands Off®* (automatic) Cast Cover, Surface-mounted, White Epoxy Paint	$ 549.00
XL - C	*Hands Off®* (automatic) Cast Cover, Surface-mounted, Chrome Plated	$ 599.00

CAST COVER MODELS

HAND DRYERS:

76-W	*Hands On®* (push button) Cast Cover, Surface-mounted, White Epoxy Paint	$ 399.00
76-C	*Hands On®* (push button) Cast Cover, Surface-mounted, Chrome Plated	$ 459.00
R76-W	*Hands On®* (push button) Cast Cover, Recessed, White Epoxy Paint	$ 459.00
R76-C	*Hands On®* (push button) Cast Cover, Recessed, Chrome Plated	$ 519.00
HO-IW	*Hands Off®* (automatic) Cast Cover, Surface-mounted, White Epoxy Paint	$ 449.00
HO-IC	*Hands Off®* (automatic) Cast Cover, Surface-mounted, Chrome Plated	$ 499.00
R76-IW	*Hands Off®* (automatic) Cast Cover, Recessed, White Epoxy Paint	$ 499.00
R76-IC	*Hands Off®* (automatic) Cast Cover, Recessed, Chrome Plated	$ 559.00

HAIR DRYERS:

H76-W	*Hands On®* (push button) Cast Cover, Surface-mounted, White Epoxy Paint	$ 399.00
H76-C	*Hands On®* (push button) Cast Cover, Surface-mounted, Chrome Plated	$ 459.00
RH76-W	*Hands On®* (push button) Cast Cover, Recessed, White Epoxy Paint	$ 459.00
RH76-C	*Hands On®* (push button) Cast Cover, Recessed, Chrome Plated	$ 519.00

LEXAN® SERIES

HAND DRYERS:

HO-BL	*Hands On®* (push button) LEXAN® Cover, Surface-mounted, White	$ 279.00
HO-IL	*Hands Off®* (automatic) LEXAN® Cover, Surface-mounted, White	$ 329.00

- *Hands On® (push button) cast cover models are available with a fixed nozzle at no additional charge.*
- *Hands Off® (automatic) models are activated by an infrared sensor.*
- *Custom colors are available for a net upcharge (pricing is based upon quantity).*
- *All dryers available in a range of voltages including 110/120V, 208/230V, 240V and 277V 60 Hz to fit most applications. Lower wattage (15 A) as well as 50 Hz models are also available. PLEASE SPECIFY.*

SECTION 104413 - FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Sections:

1. Division 10 Section "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.

1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Stainless-Steel Sheet: ASTM A 666, Type 304.

C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following.

1. J.L. Industries: Cosmopolitan Series C8137F17.
2. Larsen's: Architectural Series SS 2409-6R.
3. Potter-Roemer: Alta Series 7062-A-4.

C. Cabinet Construction: Nonrated.

D. Cabinet Material: Enameled steel sheet.

1. Shelf: Same metal and finish as cabinet.

E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

F. Cabinet Trim Material: Stainless-steel sheet.

G. Door Material: Stainless-steel sheet.

H. Door Style: Fully glazed panel with frame.

I. Door Glazing: Clear tempered glass, 3 mm.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide manufacturer's standard hinge permitting door to open 180 degrees.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Interior of cabinet and door.

2. Stainless Steel: No. 4.

L. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: Vertical.

2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: White interior.

2.6 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire Protection Cabinets: 54 inches above finished floor to top of cabinet.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.

C. Identification: Apply vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

Larsen's® Architectural Series Fire Extinguisher Cabinets Submittal and Detail Sheet

PROJECT:_____ LOCATION:_____

MODEL NUMBER:_____ QUANTITY:_____

ARCHITECT:_____ CONTRACTOR:_____

DATE:_____ DISTRIBUTOR:_____

SPECIFICATIONS:

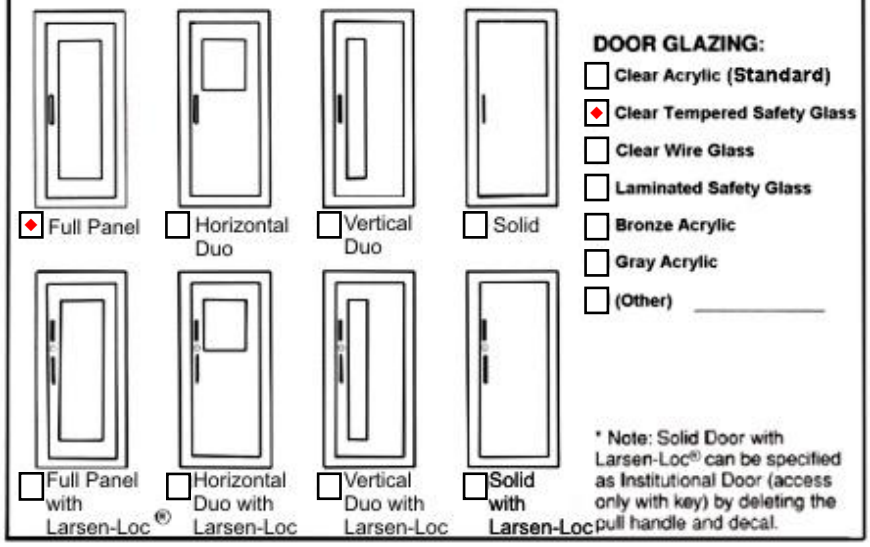
All recessed and semi-recessed cabinets and surface-mounted steel cabinets have a heavy gauge, white baked enamel box. Surface-mounted cabinets with aluminum door and trim have a box constructed entirely of clear or color anodized aluminum. Surface-mounted cabinets with stainless steel door and trim have a box constructed entirely of 304 stainless steel with a #4 finish.

Steel and stainless steel cabinets have a full ½" thick hollow metal heavy gauge door. Trims and doors feature one piece construction with satin finish pull handle, continuous matching hinge, and self-adjusting roller catch. Baked white enamel finish is standard for steel units. Stainless steel cabinets have a #4 finish, 304 stainless steel.

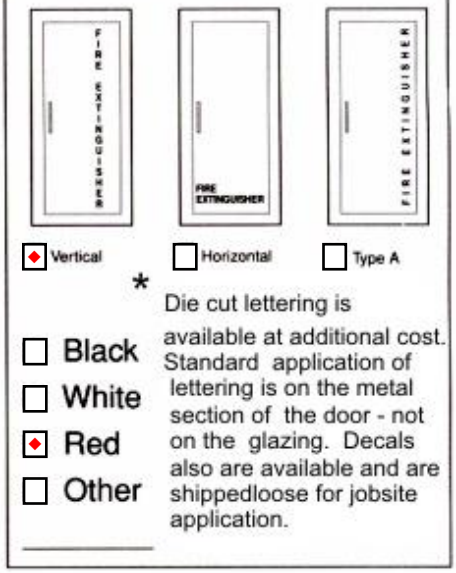
Aluminum cabinet doors and trims are extruded or fabricated aluminum with clear satin anodized finish. Aluminum door is ½" thick with satin finish matching pull handle and hinge. Color anodized finishes are available as options.

STEP 1: Select cabinet model number from the dimensions on page 2 and indicate on the top of this sheet. To specify aluminum trim and door, use the prefix, **"AL"** before the model number. To specify stainless steel trim and door, use the prefix, **"SS"** before the model number. **Note: Rough opening dimensions are larger for fire-rated cabinets. Please refer to separate Fire-Rated Cabinet Submittal and Detail Sheet.**

STEP 2: Select Door Style and Door Glazing (if applicable) below:



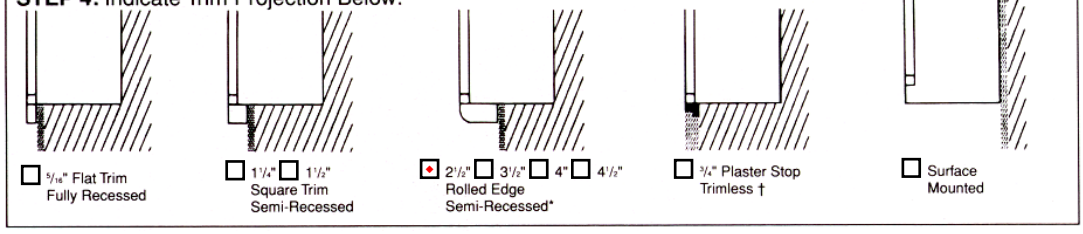
STEP 5: Select Optional* Die Cut Lettering Style and Color:



STEP 3: Indicate Trim and Door Material:

- ☐ Steel
- ☐ Aluminum (AL)
- ◆ Stainless (SS)
- ☐ Other (specify) _____

STEP 4: Indicate Trim Projection Below:



† Trimless cabinets must be installed before the drywall because their plaster stops must be behind the drywall. Trimless cabinets are not recommended for block wall installation.

* See back of this sheet or attached sheet for Recessed Handle (required only for 4" return trims when ADA wall projection compliance is necessary)

LARSEN'S MANUFACTURING COMPANY - www.larsensmfg.com
7421 Commerce Lane N.E., Minneapolis, MN 55432 Phone: (763) 571-1181 FAX: (763) 571-6900
FLORIDA DIVISION: 3130 N.W. 17th Street, Ft. Lauderdale, FL 33311 Phone: (954) 486-3325 FAX: (954) 486-3352

CABINET DIMENSIONS - ARCHITECTURAL SERIES

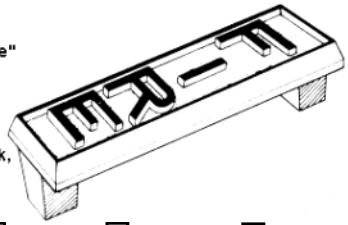
Model Number	Trim Style and Projection	Inside Box Dimensions			Outside Trim Dimensions**		Rough Opening***			Recommended Extinguisher Capacity
		Height	Width	Depth	Height	Width	Height	Width	Depth	
☐ __ 2409-R1	Rec. 5/16"	24"	9½"	5"*	27½"	13"	25"	10½"	5¼"	MP2½
☐ __ 2409-5R	Semi-Rec. 1½"	24"	9½"	5"*	27½"	13"	25"	10½"	4"	MP5, MP5
☐ __ 2409-R3	Semi-Rec. 2½"	24"	9½"	5"*	27½"	13"	25"	10½"	3"	DC ½, 5
										HT2½, HT5
☐ __ 2409-R2	Rec. 5/16"	24"	9½"	6"	27½"	13"	25"	10½"	6¼"	
☐ __ 2409-R7	Semi-Rec. 1½"	24"	9½"	6"	27½"	13"	25"	10½"	5"	
◆ __ 2409-6R	Semi-Rec. 2½"	24"	9½"	6"	27½"	13"	25"	10½"	4"	MP2½, 5
☐ __ 2409-R4	Semi-Rec. 3½"	24"	9½	6"	27½"	13"	25"	10½"	3"	MP5-A,
☐ __ 2409-RM	Semi-Rec. 4½"	24"	9½"	6"	27½"	13"	25"	10½"	2"	DC2½, DC5
☐ __ 2409-RT	Trimless	24"	9½"	6"	-	-	†	†	6½"	MP6, MP10
☐ __ 2409-SM	Surface Mounted	27½"	13"	6"	27½"	13"	-	-	-	DC6, DC10, CD5
☐ __ 2409-RA	Semi-Rec. 4"	24"	9½"	6"	27½"	13"	25"	10½"	2½"	HT2½, HT5
* Depth is 4¾" when supplied with aluminum door and trim. The AL2409-5R has a 1¼" square trim.										
☐ __ 2712-R	Rec. 5/16"	27"	12"	8"	30½"	15½"	28"	13"	8¼"	
☐ __ 2712-RK	Semi-Rec. 1¼"	27"	12"	8"	30½"	15½"	28"	13"	7¼"	All of Above
☐ __ 2712-RL	Semi-Rec. 2½"	27"	12"	8"	30½"	15½"	28"	13"	6"	PW2½, MP20
☐ __ 2712-RM	Semi-Rec. 4½"	27"	12"	8"	30½"	15½"	28"	13"	4"	DC20, CD10
☐ __ 2712-RT	Trimless	27"	12"	8"	-	†	†	†	8½"	WC-6L
☐ __ 2712-SM	Surface Mounted	30½"	15½"	8½"	30½"	15½"	-	-	-	HT11, HT15½
☐ __ 2712-RA	Semi-Rec. 4"	27"	12"	8"	30½"	15½"	28"	13"	4½"	½, ½
☐ __ 2720-R	Rec. 5/16"	27"	20"	8"	30½"	23½"	28"	21"	8¼"	
☐ __ 2720-RK	Semi-Rec. 1¼"	27"	20"	8"	30½"	23½"	28"	21"	7¼"	Two Each of the listed
☐ __ 2720-RL	Semi-Rec. 2½"	27"	20"	8"	30½"	23½"	28"	21"	6"	PW2½, MP10
☐ __ 2720-RM	Semi-Rec. 4½"	27"	20"	8"	30½"	23½"	28"	21"	4"	DC10, MP20
☐ __ 2720-RT	Trimless	27"	20"	8"	-	-	†	†	8½"	DC20, CD5,D10
☐ __ 2720-SM	Surface Mounted	30½"	23½"	8½"	30½"	23½"	-	-	-	6L, HT11, HT15½
☐ __ 2720-RA	Semi-Rec. 4"	27"	20"	8"	30½"	23½"	28"	21"	4½"	½, ½
☐ __ 3012-R	Rec. 5/16"	30"	12"	8"	33½"	15½"	31"	13"	8¼"	
☐ __ 3012-RK	Semi-Rec. 1¼"	30"	12"	8"	33½"	15½"	31"	13"	7¼"	
☐ __ 3012-RL	Semi-Rec. 2½"	30"	12"	8"	33½"	15½"	31"	13"	6"	
☐ __ 3012-RM	Semi-Rec. 4½"	30"	12"	8"	33½"	15½"	31"	13"	4"	Same as
☐ __ 3012-RT	Trimless	30"	12"	8"	-	-	†	†	8½"	2712
☐ __ 3012-SM	Surface Mounted	33½"	15½"	8½"	33½"	15½"	-	-	-	
☐ __ 3012-RA	Semi-Rec. 4"	30"	12"	8"	33½"	15½"	31"	13"	4½"	
☐ __ 3612-R	Rec. 5/16"	36"	12"	8"	39½"	15½"	37"	13"	8¼"	Same as 2712
☐ __ 3612-RK	Semi-Rec. 1¼"	36"	12"	8"	39½"	15½"	37"	13"	7¼"	
☐ __ 3612-RL	Semi-Rec. 2½"	36"	12"	8"	39½"	15½"	37"	13"	6"	**FB 3612 OPTION:**
☐ __ 3612-RM	Semi-Rec. 4½"	36"	12"	8"	39½"	15½"	37"	13"	4"	
☐ __ 3612-RT	Trimless	36"	12"	8"	-	-	†	†	8½"	☐ w/Shelf &
☐ __ 3612-SM	Surface Mounted	39½"	15½"	8½"	39½"	15½"	-	-	-	Fire Blanket
☐ __ 3612-RA	Semi-Rec. 4"	36"	12"	8"	39½"	15½"	37"	13"	4½"	
☐ __ 3216	Rec. 5/16"	32"	16"	8"	35½"	19½"	33"	17"	8¼"	
☐ __ 3216	Semi-Rec. 1¼"	32"	16"	8"	35½"	19½"	33"	17"	7¼"	
☐ __ 3216 -	Semi-Rec. 2½"	32"	16"	8"	35½"	19½"	33"	17"	6"	PW2½, MP20
☐ __ 3216	Semi-Rec. 4½"	32"	16"	8"	35½"	19½"	33"	17"	4"	DC20, CD10
☐ __ 3216 T	Trimless	32"	16"	8"	-	-	†	†	8½"	CD15
☐ __ 3216	Surface Mounted	35½"	19½"	8½"	35½"	19½"	-	-	-	WM ½, ½
☐ __ 3216	Semi-Rec. 4"	32"	16"	8"	35½"	19½"	33"	17"	4½"	

† Trimless cabinets must be installed before the drywall because their plaster stops must be behind the drywall.
Trimless cabinets are not recommended for block wall installation
** Deduct ¾" from HxW dimensions for cabinets with aluminum trim.
***** Rough openings are larger for fire-rated cabinets. Please refer to Fire-rated Extinguisher Cabinet Submittal and Detail Sheet.**

NOTE: Semi-recessed and surface-mounted cabinet compliance with ADA wall projection guidelines depends on several location and installation issues.
Please refer to http://www.larsensmfg.com

☐ OPTIONAL "FIRE" HANDLE

Optional die cast "Fire" Handle is available at additional cost. Natural finish is standard. Optional finishes are red, black, and white.



☐ Standard ☐ Red ☐ Black ☐ White

☐ OPTIONAL RECESSED HANDLE

Optional recessed handle is available at additional cost for Solid, H-Duo or V-Duo Doors. Larsen-Loc® is also available with recessed handle. The recessed handle must be specified with 4" projecting trims in order for the cabinet to comply with ADA wall projection guidelines.

Recessed Handle with Solid Door

Recessed Handle with V-Duo Door

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FLORIDA DIVISION: 3130 N.W. 17th Street, Ft. Lauderdale, FL 33311 Phone: (954) 486-3325 FAX: (954) 486-3352

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."
2. Section 233813 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

C. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. J. L. Industries, Inc.; a division of Activar Construction Products Group.
f. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
g. Larsen's Manufacturing Company.
h. Potter Roemer LLC.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

D. Wet-Chemical Type: UL-rated 2-A:1-B:C:K, 2.5-gal. nominal capacity, with potassium carbonate-based chemical in stainless-steel container; with pressure-indicating gage. Provide in Kitchen area.

E. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Amerex Corporation.
b. Ansul Incorporated; Tyco International Ltd.
c. Badger Fire Protection; a Kidde company.
d. Buckeye Fire Equipment Company.
e. Fire End & Croker Corporation.
f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
g. Larsen's Manufacturing Company.
h. Potter Roemer LLC.

2.3 IDENTIFICATION

A. Identification: Projecting sign with lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.

1. Available Products:

a. PTD-182 by Larsen.
b. PTD109 by J.L. Industries.

2. Location: Applied to wall above extinguisher.
3. Application Process: Pressure-sensitive tape or screw fasteners.
4. Lettering Color: White on red background with graphic of fire extinguisher and arrow pointing down.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in cabinets and on mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

END OF SECTION 104416

Larsen's® Fire Extinguishers — MP,DC & HT Series

Submittal and Detail Sheet

PROJECT:_____ LOCATION:_____

MODEL NUMBER:_____ QUANTITY:_____

ARCHITECT:_____ CONTRACTOR:_____

DATE:_____ DISTRIBUTOR:_____

MP SERIES-Multi-Purpose Dry Chemical

These units contain specially fluidized and siliconized mono ammonium phosphate powder which smothers and breaks the chain reaction on Class B fires, fuses and insulates Class A fires, and, as a non-conductor of electricity, is effective on Class C fires.

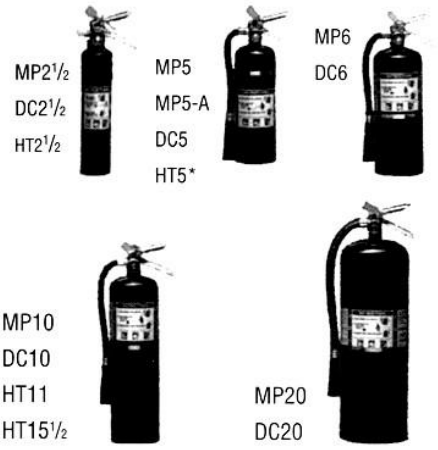
DC SERIES-Regular Dry Chemical

These units contain specially siliconized sodium bicarbonate powder with free flowing and non-caking additives, suitable for fires in flammable liquids, and energized electrical equipment.

All multi-purpose and regular dry chemical units feature: Heavy DOT steel cylinders * Rugged metal valves and siphon tubes * Replaceable molded valve stem seals * Pull pin-upright squeeze grip operation * Approved to -65 degrees F. * Non-toxic * Pressure gauges*

HT SERIES-Halotron I

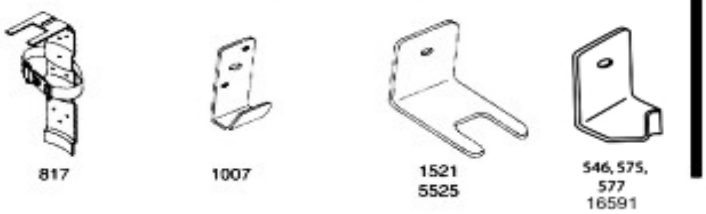
Halotron I is an EPA approved clean agent which discharges as a rapidly evaporating liquid, leaving no residue. It effectively extinguishes Class A, B and C fires and is intended for use in areas formerly protected by Halon 1211.



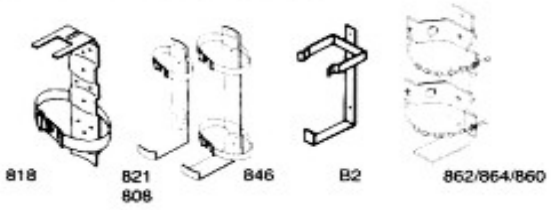
***Note:** HT5 is equipped with nozzle in lieu of hose and horn.*

MODEL NUMBER	NOMINAL CAPACITY	SHIPPING WEIGHT	CYLINDER DIAMETER	OVERALL HEIGHT	OVERALL WIDTH	UL RATING	STANDARD BRACKET*	OPTIONAL BRACKET**
MP2½	2½ lbs.	5½ lbs.	3 in.	15½ in.	5¾ in.	1A-10B:C	817	860
MP5	5 lbs.	9¼ lbs.	4¼ in.	15¼ in.	7¼ in.	2A-10B:C	1 5	2, 818, 821, 86
MP5-A	5 lbs.	9¼ lbs.	4¼ in.	15¼ in.	7¼ in.	3A40B:C	1 5	818, 821, 86
MP6	6 lbs.	12¾ lbs.	5 in.	16 in.	7¾ in.	3A-40B:C	5525	808, 862
MP10	10 lbs.	18 lbs.	5 in.	20in.	7¾ in.	4A-80B:C	546	B-2, 846, 862
MP20	20 lbs.	38 lbs.	7 in.	23¼ in.	10¼ in.	OA-12OB:C	577	864
DC2½	2½ lbs.	5½ lbs.	3 in.	15½ in.	5-3/4 in.	IOB:C	817	860
DC5	5½ lbs.	9½ lbs.	4¼ in.	15¼ in.	7¼ in.	4OB:C	1 5	B-2, 818, 821, 86
DC6	6 lbs.	13 lbs.	5 in.	16¼ in.	8½ in.	4OB:C	546	808, 862
DC10	10 lbs.	18 lbs.	5 in.	20 in.	7-3/4 in.	6OB:C	546	B-2, 846, 862
DC20	20 lbs.	38 lbs.	7 in.	23¼ in.	10¼ in.	12OB:C	577	864
HT2½	2½ lbs.	5¼ lbs.	3 in.	15½ in.	5½ in.	2B:C	817	860
HT5	5 lbs.	9½ lbs.	4¼ in.	15¼ in.	5-3/4 in.	5B:C	818	860
HT11	11 lbs.	22½ lbs.	6 in.	21 in.	9¼ in.	1A:10B:C	5 5	
HT15½	15½ lbs.	27½ lbs.	6 in.	21 in.	9¼ in.	2A:10B:C	5 5	

STANDARD BRACKETS*



OPTIONAL BRACKETS*



***NOTE:** Standard brackets are included with all extinguishers at no additional cost. If specified, optional brackets are only available at additional cost. All of the above brackets are designed to accommodate Larsen's extinguishers. While most comparably sized extinguishers usually will function with the above brackets, Larsen's cannot assume responsibility for variations in cylinder dimensions among various extinguisher suppliers.*

LARSEN'S MANUFACTURING COMPANY
7421 Commerce Lane N.E., Mpls, MN 55432
Phone: (763) 571-1181 FAX: (763) 571-6900
www.larsensmfg.com

FLORIDA DIVISION:
3130 N.W. 17th Street, Ft. Lauderdale, FL 33311
Phone: (954) 486-3325 FAX: (954) 486-3352

SECTION 111300 - LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Dock levelers.

1.3 DEFINITIONS

A. Operating Range: Maximum amount of travel above and below the loading dock level.

B. Working Range: Recommended amount of travel above and below the loading dock level for which loading and unloading operations can take place.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for loading dock equipment. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For loading dock equipment. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Welding certificates.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency; indicate compliance of dock levelers with requirements in MH 30.1 for determining rated capacity, which is based on comprehensive testing within last two years of current products.

1. Submittal Form: According to MH 30.1, Appendix A.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For loading dock equipment to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Source Limitations: Obtain dock levelers from single source from single manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with loading dock equipment, including slopes of driveways and heights of loading docks, by field measurements before fabrication.

1.9 WARRANTY

A. Special Warranty for Dock Levelers: Manufacturer's standard form in which manufacturer agrees to repair or replace dock-leveler components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracked or broken structural support members, load-bearing welds, and front and rear hinges.
b. Faulty operation of operators, control system, or hardware.
c. Deck plate failures including cracked plate or permanent deformation in excess of 1/4 inch between deck supports.
d. Hydraulic system failures including failure of hydraulic seals and cylinders.

2. Warranty Period for Structural Assembly: 1 year from date of Substantial Completion.
3. Warranty shall be for unlimited usage of leveler for the specified rated capacity over the term of the warranty.

1.10 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of loading dock equipment Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper loading dock equipment operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55.

C. Steel Tubing: ASTM A 500, cold formed.

D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

E. Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.

F. Pressure-Treated Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried, and pressure treated with waterborne preservatives to comply with AWPA C2.

2.2 EDGE-OF-DOCK LEVELERS

A. General: Surface-mounted, hinged-lip-type, edge-of-dock levelers designed for permanent installation on face of loading dock platform; of type, function, operation, capacity, size, and construction indicated; and complete with controls, safety devices, and accessories required.

1. Basis-of-Design Product: Subject to compliance with requirements, provide MD-CM Series by Blue Giant Equipment Corporation or comparable product by one of the following:

a. Beacon Industries, Inc.
b. Chalfant Dock Equipment.
c. McGuire, W. B. Co., Inc.; Division of Overhead Door Corporation.
d. Pentalift Equipment Corporation.
e. Pioneer Loading Dock Equipment.
f. Poweramp; Division of Systems, Inc.
g. Rol-Lift Corporation.

B. Standard: Comply with MH 30.1.

C. Rated Capacity: Capable of supporting total gross load of 20,000 lbs. without permanent deflection or distortion.

D. Platform Ramp Width: 72 inches.

E. Hinged Lip: Not less than 3/8-inch- thick, nonskid steel tread plate.

1. Hinge: Full width, piano-type hinge with heavy-wall hinge tube and greased fittings, with gussets on lip and ramp for support.

F. Function: Dock levelers shall compensate for differences in height between truck bed and loading platform.

1. Vertical Travel: Operating range above platform level of sufficient height to enable lip to extend and clear truck bed before contact with the following minimum working range:

a. Above Adjoining Platform: 5 inches.
b. Below Adjoining Platform: 5 inches.

2. Automatic Vertical Compensation: Floating travel of ramp with lip extended and resting on truck bed shall compensate automatically for upward or downward movement of truck bed during loading and unloading.
3. Automatic Lateral Compensation: Tilting of ramp with lip extended and resting on truck bed shall compensate automatically for canted truck beds of up to 3 inches over width of ramp.
4. Lip Operation: Manufacturer's standard mechanism that automatically extends and supports hinged lip on ramp edge with lip resting on truck bed over dock leveler's working range, allows lip to yield under impact of incoming truck, and automatically retracts lip when truck departs.

a. Length of Lip Extension: 15 inches.

5. Automatic Ramp Return: Automatic return of unloaded ramp, from raised or lowered positions to stored position, level with platform, as truck departs. Leveler shall be capable of retracting to stored position while truck is at loading dock.

G. Mechanical Operating System: Manual control; counterbalance and spring operation. Spring-operated raising and walk-down lowering of unloaded ramp. Equip leveler with a torsion-spring counterbalancing mechanism controlled by a hold-down device.

1. Lever Handle: Self-storing lever handle for raising unloaded ramp with minimal lifting force by pulling lever back to extend lip and pushing lever forward to lower ramp and lip.
2. Removable Lifting Handle: For raising unloaded ramp by lifting action.

H. Construction: Fabricate dock-leveler frame, platform supports, and lip supports from structural- and formed-steel shapes. Weld platform and hinged lip to supports. Fabricate entire assembly to withstand deformation during both operating and stored phases of service. Chamfer lip edge to minimize obstructing wheels of material-handling vehicles.

1. Cross-Traffic Support: Manufacturer's standard method of supporting ramp at platform level in stored position with lip retracted. Provide a means to release supports to allow ramp to descend below platform level.
2. Maintenance Strut: Integral strut to positively support ramp in up position during maintenance of dock leveler.

I. Integral Molded-Rubber Dock Bumpers: Fabricated from 4-inch thick, heavy molded-rubber compound reinforced with nylon, rayon, or polyester cord; with Type A Shore durometer hardness of 80, plus or minus 5, when tested according to ASTM D 2240. Provide two dock bumpers for each recessed dock leveler, attached to face of loading dock with expansion bolts.

J. Dock-Leveler Finish: Painted in manufacturer's standard color.

2.3 GENERAL FINISH REQUIREMENTS

A. Finish loading dock equipment after assembly and testing.

2.4 STEEL FINISHES

A. Steel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat in manufacturer's standard color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

B. Place self-forming pan system for edge-of-dock levelers in proper relation to loading platform before pouring concrete.

3.3 INSTALLATION

A. General: Install loading dock equipment, including accessories as required for a complete installation.

B. Edge-of-Dock Levelers: Attach dock levelers to loading dock platform in a manner that complies with requirements indicated for arrangement and position relative to top of platform.

1. Weld anchor holes in contact with continuous embedded loading dock edge channel. Weld or bolt bumper blocks to face of loading dock.

3.4 ADJUSTING

A. Adjust loading dock equipment to function smoothly and safely, and lubricate as recommended by manufacturer.

B. Test dock levelers for vertical travel within operating range indicated.

C. After completing installation of exposed, factory-finished loading dock equipment, inspect exposed finishes and repair damaged finishes.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain loading dock equipment.

END OF SECTION 111300

MD-CM Series

mechanical edge-of-dock leveler

BLUE GIANT®

Operator friendly with no lifting involved…

…simple, easy “pull-push” operation.

Features

- Deck and lip operation assisted by balanced spring lifting system
- Smooth top plate transition
- Comfort grip operating handle
- Lifting hole in lip allows for quick and easy handling by installer

Structural Integrity

- Deck and lip plates made of premium grade 50,000 psi minimum yield diamond tread plate
- Heavy-duty 3/8" x 6" (9.65 mm x 152 mm) back beam
- One-piece, continuous front and rear hinge pins for enhanced strength and durability
- Lip bevel helps protect material handling equipment steering systems and cargo
- Two (2) molded rubber bumpers bolted onto heavy-duty steel block extensions, to help protect building and dock from damage

Operation

- Easy to deploy, less effort “operator maintains balanced control”
- Working range capability of 5" (127 mm) above and 5" (127 mm) below dock level
- Self-storing upon truck departure

Ease of Service

- Comfort grip handle has secondary use as maintenance stand
- Grease fittings on 25,000 lb (11,363 kg) and 30,000 lb (13,636 kg) capacities to minimize operational friction
- Field adjustability for kicker bar and spring tension

Associated products

- Vehicle restraint systems
- Light communication systems
- Wheel chocks

The MD-CM Series edge-of-dock leveler from Blue Giant is ideally suited for applications where installation of pit levelers is not feasible or where standard fleet bed heights are serviced at the loading dock. The MD-CM Series is easily installed to the dock face providing an efficient self storing docking unit, replacing cumbersome dock plates.

Stored traffic position

Insert comfort grip handle — Pull back — Push forward

To meet OSHA and ANSI requirements and to minimize legal/insurance issues, the use of wheel chocks (at a minimum) is mandatory anytime equipment is used at the dock to load/unload vehicles. However, with the high lifetime cost of wheel chocks and their limited effectiveness, we recommend the combined use of vehicle restraints and wheel chocks as the accepted method of securing trucks to the dock. Blue Giant provides leading technology in manual and/or power activated vehicle restraints. Maximize your employee safety while providing your company a modern, safe loading dock area.

Note: Some components are not illustrated.

MD-CM Series Mechanical Edge-of-Dock

Mechanical edge-of-dock shall be Model _____, unit nominal size to be _____ wide x _____ long, as provided by Blue Giant Equipment Corporation, 85 Heart Lake Road South, Brampton (Ontario) Canada L6W 3K2.

Standard Construction Features
- 15" (381 mm) lip with bevel edge
- Hole in lip to help with easy handling and installation
- Welding procedure compliant with A.W.S.D.1.98 specifications
- Deck and lip constructed out of high tensile steel
- Four way diamond tread plate
- Two (2) molded rubber dock bumpers 10" W x 13" H x 4" D (254 mm x 330 mm x 102 mm) mounted to heavy-duty bumber blocks

Mechanical Operating System
Provides quiet, dependable and smooth cycling.
1. Insert the operating handle deck and side pocket.
2. Pull the comfort handle back; the spring-assisted deck raises to a vertical position.
3. Pushing the handle forward lowers the deck, and lip automatically extends onto trailer.

Lip Operation
Lip automatically extends as unit is lowered onto truck bed and returns to stored position upon truck departure. The length of the lip shall not be less than 15" (381 mm).

Automatic Vertical Compensation and Travel
Unit provides float up to 5" (127 mm) above and below dock level.

Automatic Lateral Compensation
Leveler shall have deck flex to compensate for canted (out of level) truck beds.

Rated Capacity
- ☐ 20,000 lb (9090 kg)
- ☐ 25,000 lb (11,363 kg)
- ☐ 30,000 lb (13,636 kg)

Optional Features
- ☐ 17" (432 mm) lip
- ☐ Flat lip

Serviceability
- Comfort grip handle has secondary use as maintenance stand
- Grease fittings provided on 25,000 lb (11,363 kg) and 30,000 lb (13,636 kg) units
- Field adjustability for kicker bar and spring tension

Finish and color
- Unit to be painted gray

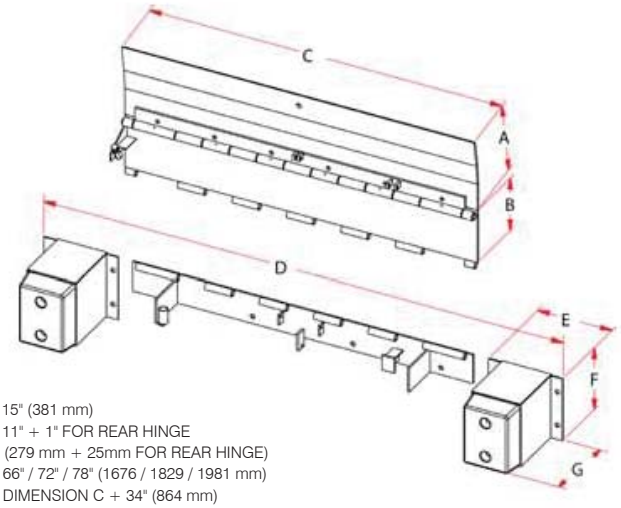
MODEL	CAPACITY	DECK SIZE (W x L)
☐ MDC66__M	☐ 20,000 lbs (9,090 kg) ☐ 25,000 lbs (11,363 kg) ☐ 30,000 lbs (13,636 kg)	66" x 27" (1676 mm x 686 mm)
☐ MDC72__M		72" x 27" (1828 mm x 686 mm)
☐ MDC7825M	☐ 25,000 lbs (11,363 kg)	78" x 27" (1981 mm x 686 mm)

Warranty
Standard one-year parts and labor warranty from date of shipment. Warranties are subject to standard limitations on liability. Please consult Blue Giant warranties at http://www.BlueGiant.com for full details on warranty information and product registration.

Installation Accessories
- ☐ Approach ramps
- ☐ Face plates
- ☐ 8" (203 mm)Pour-in channel

Optional Products
- ☐ Vehicle restraint systems
- ☐ Communication systems
- ☐ Wheel chock systems

Nominal Dimensions



A = 15" (381 mm)
B = 11" + 1" FOR REAR HINGE
(279 mm + 25mm FOR REAR HINGE)
C = 66" / 72" / 78" (1676 / 1829 / 1981 mm)
D = DIMENSION C + 34" (864 mm)
E = 15 1/2" (394 mm)
F = 13" (330 mm)
G = 16" (406 mm)

Note: **1.** Recommend minimum 8" (203 mm) structural concrete embedment (pour-in) channel, installed by others. Some components are not illustrated. Mounting anchors are not included.
2. Working range reduced by 2" (51 mm) when ordered with 17" (432 mm) lip and/or flat lip option.

BLUE GIANT

85 Heart Lake Road South
Brampton, Ontario, Canada L6W 3K2
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www.BlueGiant.com

BLUE GIANT EQUIPMENT CORPORATION

AUTHORIZED DISTRIBUTOR

SECTION 114000 - FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. The General Conditions, Supplementary Conditions, and applicable portions of Division 1 of the specifications are a part of this section.
B. Furnish and install includes the work as follows, but not limited to:
C. Furnish all labor, materials and services necessary for the assembly and setting in place of the equipment in strict compliance and accordance with the contract documents.
D. Coordinate requirements for wall reinforcements and special support locations.
E. Provide stands and supports for equipment requiring such. In areas requiring seismic bracing, provide special support to comply with seismic standards. (The structural engineer shall approve such supports.)
F. Cut holes; provide sleeves for pipes in equipment, for drains, electrical work, plumbing work, etc., as required for proper installation.
G. Repair any damage resulting from installation.
H. Remove all debris resulting from this installation, clean, repair, and adjust all equipment for operation, as well as provide an acceptance test by the Owner.

1.2 CONTRACT DOCUMENTS

A. Equipment drawings are definitive only and shall not be used as construction documents or shop details.
B. Drawings and equipment specifications are intended to compliment each other; therefore, neither should be considered complete without the other.
C. Drawings are for reference, assistance and guidance only. Drawings indicate the preferred final location of equipment. The exact final location will be dictated by the building conditions.

1.3 SUBSTITUTIONS - ALTERNATE EQUIPMENT

A. The base bid shall include all prime equipment specified including specific manufacturer, model number, size, utility requirements, capacities, etc., as well as options and accessories.
B. Supplemental to the bid based on the prime equipment as specified, the Contractor may propose substitutions (alternate equipment other than that specified). The Contractor must clearly and separately state that they are offering an alternate. The Contractor shall submit complete illustrations, specifications, capacities, and utilities, as well as operational data for all proposed alternates and applicable price differences. It is the Contractor's responsibility to prove that the item or items submitted as alternates are equal to the prime specified items. The Owner, with counsel from the Food Service Consultant, will be the final determining authority as to acceptability or equality of alternates. Items of standard equipment must be the latest model and new at time of delivery.
C. Contractor is responsible for all costs associated with an approved alternate item if the item requires additional space or specific utilities which differ from the prime equipment or design intent specified. The Contractor is responsible for all costs associated with any physical plant retrofitting caused by use of alternate equipment such as but not limited to building, utility, engineering changes and all associated design fees. The Owner must approve all alternates and substitutions.

1.4 LAWS AND ORDINANCES

A. Certify that all work and material comply with Federal, State and local laws, ordinances and regulations and confirm by the local inspector having jurisdiction.

B. Work and materials must be in full accord and, when appropriate, must be listed as acceptable with the following agencies:

1. U.S. Public Health Service
2. Local Health Department
3. National Board of Fire Underwriters
4. O.S.H.A.
5. National Sanitation Foundation (N.S.F.)
6. Underwriter Laboratories (U.L.)
7. A.S.M.E.
8. A.G.A.
9. N.F.P.A. - 96 for exhaust system

C. Check and confirm that drawings and specifications meet all Federal, State and local government body regulations. The drawings and specifications govern wherever they have larger sizes or higher standards than required by such regulations. Applicable regulations will govern when they are more restrictive or require higher standards than requested by the Contract Documents. All costs for compliance with said regulations shall be borne by the Contractor regardless of what is contained in the Contract Documents.

1.5 GUARANTEES AND WARRANTY

A. Fully warrant all equipment by manufacturer's warranty for parts and labor for ninety (90) days after final acceptance by the Owner.

B. Fully guarantee all equipment against defects in workmanship and material for one year after Owner's final acceptance. Make all repairs and replacements without charge. Commence guarantee period with the first usage of the equipment for the intended purpose after final acceptance.

1.6 ROYALTIES

A. Pay all royalties and license fees required for equipment and indemnify all parties to this contract from the payment of any royalties, damages, losses or expenses for suits, claims or otherwise, growing out of alleged infringement of patents, materials and methods used in the execution of this contract.

1.7 EQUIPMENT ACCESS

A. Verify all building conditions and coordinate with the Owner or Owner's representative proper access of large equipment to the building. Costs for any specific items or equipment required for the movement of large, heavy or bulky equipment including rigging, carnage, etc. is solely the full responsibility of the Contractor.

B. The shop details, rough-in drawings, cut sheet book and any other submittals for this section are to be submitted at the same time in a single package. Partial submittals will be held without action until the remainders of the submittals have been received.

1.8 SUBMITTALS

A. Shop Details

1. Submit one (1) blue line set and one (1) high quality, reproducible paper sepia set of shop drawings of all custom fabricated equipment at minimum 3/4-in. (120) scale. Include with all custom fabrication drawings dimensions, fabrication methods,

materials, thickness, details of construction, installation and method of field joints noted. Shop details must indicate reinforcements, methods of anchorage and quality of finishing. The sepias will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution.

2. Contractor shall verify all field dimensions and incorporate them into shop drawings.

B. Rough-in Drawings

1. Submit one (1) blue line set and one (1) high quality, reproducible paper sepia set of complete and detailed rough-in drawings. Drawings shall show every piece of equipment, all dimensions for rough-in points for electrical, plumbing, steam, exhaust, gas, thermo fluid, refrigeration, wash down hoods, as well as concrete curbs, sleeves, supports, etc. and all core drilling needed. The sepias will be reviewed, marked, stamped with required action noted and returned for appropriate action and copying for distribution.

C. Cut Sheet Book

1. Assemble and bind two (2) sets of Equipment Brochure books as part of the submittal. Show all specified accessories, utility requirements and all other pertinent information on equipment cuts. The books will be reviewed, marked, stamped with required action noted and one (1) copy returned for appropriate action and copying for distribution.

1.9 START-UP DEMONSTRATION AND MANUALS

A. Provide factory-trained engineers for start-up and demonstration of equipment. Demonstration shall be done in two stages: one for operation and the second to maintenance personnel.

B. Return to the job site within ten (10) days after the demonstration for final adjustment and calibration of equipment.

C. Furnish three (3) service/parts and maintenance manuals for all equipment supplied as part of this contract.

D. Prepare a list of service agencies authorized by each manufacturer to service its equipment. Include within this listing the name of the person to contact and a telephone number for reference purposes.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS OF FABRICATION

A. Fabrication methods shall conform to all generally accepted conventions and requirements of the food service industry and shall meet or exceed the latest National Sanitation Foundation standards including all revisions.

2.2 MATERIALS

A. Stainless Steel

1. Stainless steel shall be of U.S. standard gauges as indicated, but not less than 20 gauge, Type 304 with No. 4 finish.

B. Galvanized Steel

1. Galvanized Steel shall be of 14 gauge or as otherwise indicated on drawings or specifications and shall be electro-galvanized. Galvanized steel shall be used in all non-exposed areas, areas with no contact with food or serving items and in framework. When used in framework, galvanized steel shall be of welded construction (welding is to be done before galvanizing).

C. Insulation Materials

1. For normal temperature applications, such as custom fabricated under-counter refrigerators, use styrofoam material 2 in. (50 mm) thick, bonded at all joints.

2. For heated-type application, such as plate warmers, use block-type rock wool, minimum 1 in. (25 mm) thick.
3. For low temperature applications, such as ice bins, cold pans, or custom fabricated under counter freezers, use urethane, rigid foam board or foamed-in-place, not less than 2 in. (50 mm) thick, except the vertical surfaces of cold pans and ice bins may be 1 in. (25 mm) thick. Bond the insulation at joints to prevent condensation on exterior.
4. At counter tops subject to heat from cooking equipment and/or refrigeration compressors, use 1 in. (25 mm) thick Manville Martinite 36, or equal, to insulate underside of top. Also add Martinite material between freezer or refrigerator and 14-gauge (1.98mm) stainless steel top.
5. Fiberglass insulation materials shall not be used. Insulation shall be bounded to all surfaces.

D. Laminated Plastic
1. Shall be Formica, Parkwood, LaminArt & Wilson Art or approved equal.
2. Veneer with approved waterproof and heatproof cement. Rubber base adhesives are not acceptable.
3. Apply directly over close-grained plywood, such as solid Mahogany or solid Birch, of selected, smooth, sanded stock to ensure a smooth ripple-free laminated surface.
4. If specified plywood is unavailable, submit specifications and samples of alternate material for approval.
5. Face exposed faces and edges with 1/16 in. (1.6 mm) thick material. Corresponding back to be covered with approved backing/balancing sheet material.

2.3 METAL TOP CONSTRUCTION

A. Metal tops to be one-piece 14-gauge stainless steel welded construction or as indicated on drawings or specifications, including field joints. Tops to be secured to a full perimeter galvanized steel channel frames except at wood top tables, drainboards and dishtable where channel frames shall be stainless steel and cross-braced not farther than 30 in. (760 mm) on center. Fasten top with stud bolts or tack welds. Coat underside of tops with a minimum 1/16 in. (1.6 mm) thick approved hard-drying, sound-deadening, mastic material. Apply all coatings by spreading after top has been secured to frame, such that top and frame are covered and sealed.

2.4 ENCLOSED CABINET BASES

A. Fabricate bases from not less than 18 gauge (1.27 mm) steel reinforced by forming metal ends and shelves. Partitions to be constructed of stainless steel. The ends and vertical partitions can be of single wall construction, with a 2 in. (50 mm) face partitions and sides shall be welded at intersections and be flush with the bottom edge of the bottom shelf.
B. Unexposed backs and structural members may be constructed of galvanized steel.
C. Intermediate shelves to be removable. Bottom shelves shall be removable to allow access for cleaning when the cabinet is on a masonry base.

2.5 LEGS AND CROSS RAILS

A. Legs and cross rails to be of 1 5/8 in. (941 mm), 16 gauge (1.59 mm) seamless stainless steel tubing. All cross rails to be continuously welded, ground and polished. Tack welds or other methods of connection are not acceptable. Bottoms of legs to be wedged inward and fitted with a stainless steel bullet-type foot with no less than 2 in. adjustment. Freestanding legs are to be pegged to floor with 1/4 in. (6 mm) diameter stainless steel rods.

B. Stainless steel gussets shall not be less than 3 in. (76 mm) diameter and 3/4 in. (95 mm) long. Outer shell to be 16-gauge (1.59 mm) stainless steel reinforced with 12 gauge (2.78 mm) mild steel insert welded to interior of shell. Gusset to be large enough to accommodate a 1-5/8 in. (41 mm) tube and shall have an Allen screw fastener.

C. Low counter legs shall be constructed of stainless steel exterior and shall be 5 3/4 in. (146 mm) minimum height or 7 in. (178 mm) maximum height with 3 1/2 in. (89 mm) square plate with four countersunk holes, welded to the top for fastening.

D. Adjustable feet to be constructed of stainless steel 1/2 in. (38 mm) diameter tapered at the bottom to 1 in. (25 mm) diameter, fitted with a 3/4 in. (19 mm) cold-rolled rod threaded for minimum of 1/2 in. (38 mm) for fitting into a threaded plug welded to leg. A push-in foot is not acceptable.

E. When legs are fastened to equipment, the following methods must be used:

1. Sinks: Gussets shall be welded to triangular stainless steel plates, which in turn shall be welded to the underside of sink.
2. Metal Top Table or Dishtable: Gussets shall be welded to 14 gauges or heavier channel reinforcing.
3. Wood Top: Gusset shall be welded to a stainless steel channel of not less than 14 gauge stainless steel (1.98 mm), secured to the top with screws through slotted holes.

2.6 SHELVES

A. When shelves are part of the fixture, the following must take place:

1. Open base type shelf shall be notched around the leg and continuously welded to the leg.
2. Cabinet base type shelf shall be turned-up 2" on the backside with a minimum of 1/4 in. (6 mm) radius to insure a tight fit to enclosure panels.

2.7 SINKS, STEAM TABLES AND BAIN MARIES

A. When multiple compartments are part of the design, they shall be continuous on the exterior without applied facing strips or panels. Bottoms of each compartment to be creased to ensure complete drainage to waste opening.

B. Partitions between compartments to be double thickness, continuous and welded.

C. Where sink bowls are exposed, the exterior shall be polished to a number 4 finish.

D. Furnish following drains, wastes and faucets manufactured by Fisher Mfg. Co. or equal by Standard Keil, T&S or Chicago loose for installation by Plumbing Contractor:

1. Basket strainer drains shall be Fisher Model #6555 with 3 1/2 in. (89 mm) basket.
2. Rotary drains shall Fisher Model 6100 rotary type waste with connected overflow. Valve to be 2 in. (50 mm) chrome plated.
3. Water stand bain maries shall be fitted with 2 1/2 in. (50 mm) waste with basket strainer with connected overflow and adapter to connect to 1/2 in. (38 mm) drain line. Use Standard Keil box pattern basket, drain number 4161-Cp with 458-X overflow head.
4. Furnish faucets for all sinks, bain maries, water stations and other fixtures as specified.
5. Provide vacuum breakers on equipment requiring them as furnished under this contract in accordance with governing codes.

2.8 OTHER CUSTOM FABRICATED COMPONENTS

A. Casters
1. Shall be heavy-duty type, ball bearing, solid or disc wheel with non-marking greaseproof rubber & neoprene or polyurethane tires as specified.
2. Wheels shall be 5 in. (127 mm) diameter or as specified, minimum width of treads 2 1/2 in. (30 mm), with a minimum capacity per caster of 250 lbs. (113.4 kg).
3. Solid material wheels shall be provided with stainless steel rotating wheel guards.
4. Shall be sanitary, have sealed wheel and swivel bearings and polished plate finish.

B. Doors
1. Metal doors shall be double-cased stainless steel. Outer pan shall be 18-gauge (1.27 mm) stainless steel with corners welded, ground smooth, and polished. Inner pan shall be 20-gauge (.95 mm) stainless steel fitted tightly into outer pan with a sound-deadening material such as Celotex or Styrofoam used as a core. The two pans shall be tack-welded together and joints solder-filled. Doors shall be finished approximately 3/4 in. (19 mm) thick, and be fitted with flush recessed type stainless steel door pulls.
2. Sliding doors shall be self-closing, mounted on large, quiet ball-bearing rollers in 14 gauge (1.98 mm) stainless steel overhead tracks and be removable without the use of tools. Bottom of cabinet to have stainless steel guide-pins and not channel tracks for doors.
3. Wood doors to be custom fabricated as detailed. If plastic laminate surfaces are used, all sides and edges shall be laminated.
4. Hinged doors to be mounted on heavy-duty N.S.F. approved hinges, Model #2970-1010-1250 by Standard Keil or as noted on plans or specifications.

C. Hardware
1. Shall be solid, heavy-duty type.
2. Identify manufacturer's name and number so that broken or worn parts may be replaced.
3. Submit samples for approval, when requested.
4. Pulls shall be Standard Keil Hardware, or approved equal as follows:
   a. Door Pulls - Model No. 1263-1010-1283
   b. Drawer Pulls - Model No. 1263-1012-1283

D. Dipperwells
1. Dipperwells shown on drawings or specified shall be Fisher Mfg. Co. Model 3041 or equal by Standard Keil.

E. Drawer Assemblies
1. Assemblies shall consist of removable drawer body mounted in a ball bearing slide assembly with padlock hasp.
2. Slide assembly shall consist of one pair of stainless steel roller bearing extension slides with side and back enclosure panels, front spacer angle, two drawer carrier angles secured to slides and stainless steel front.
3. Slides are to be Model No. 3320-22 (250 lb. capacity fully extended) (113.4 kg) made by Grant Pulley and Hardware Co., or equal.
4. Drawer bodies for general storage shall be 20" X 20" (508 mm X 508 mm) or as specified with Royalite containers as manufactured by United States Rubber Co.
5. Drawers intended shall hold food products to be removable type with 12" x 20" (305 mm X 508 mm) stainless steel assembly.
6. Drawer fronts shall be double cased, 3/4 in. (19 mm) thick, with 18-gauge (1.27 mm) stainless steel welded and polished front pan. Stainless steel back pan is shall be tightly fitted and tack welded. Sound deaden with rigid insulation.
7. Provide all drawers with replaceable soft neoprene bumpers or, for refrigerated drawers, a full perimeter soft gasket.

2.9 CUSTOM FABRICATED WORKMANSHIP

A. Items of specially custom fabricated equipment must be custom fabricated by an acceptable manufacturer, who is N.S.F. approved and custom fabricated in an approved manner to the complete and final satisfaction of the Owner or Owners representative.

B. Welding and Soldering
   1. Materials 18 gauge (1.27 mm) or heavier, shall be welded.
   2. Seams and joints shall be shop-welded or soldered, as the nature of the material will require.
   3. Welds shall be ground smooth and polished to match original finish.
   4. Where galvanizing has been burned off, the weld shall be cleaned and touched up with high-grade aluminum paint.
   5. Fasteners and Joints
      a. The following will not be accepted:
         - Exposed screw or bolt heads.
         - Rivets.
         - Butt joints made by riveting straps under seams and then filled with solder.

C. Rolled Edges
   1. Rolled edges to be as detailed, with corners bull nosed, ground and polished.

D. Coved Corners
   1. All stainless steel food service equipment shall have 1/2 in. (13 mm) or larger radius coves in all horizontal and vertical corners and intersections per N.S.F. standards.

E. Closures
   1. Where ends of fixtures, backsplashes, shelves, etc. are open, fill by forming the metal, or weld sections, if necessary, to close entire opening flush to walls or adjoining fixtures.

2.10 OPERATION REQUIREMENTS

A. Insure quiet operation of food service and related equipment. Provide sound deadening on all tables, counters, undershelves, sinks and drainboards.

B. Insure bumper gaskets, stops, and any other protection is installed on all custom fabricated equipment as needed.

2.11 CONNECTION TERMINALS

A. All custom fabricated equipment shall be provided with standard connection terminals to allow other contractors to make final connections on job site.

2.12 EXHAUST HOODS/WALK-IN COOLERS AND DISHMACHINES

A. Verify size and location of all connections required before fabrication.

B. Check job site prior to installation of walk-in coolers to verify proper dimensions and for required trim.

C. Provide stainless steel duct collars at ceiling or wall duct connection points, where exposed.

D. Provide all stainless steel duct connections and collars for exposed ducts.

2.13 INSERT PANS

A. All cutouts, openings, drawers, and equipment specified or detailed to hold stainless steel insert pans shall be provided with a full compliment of pans as follows:
   1. One (1) stainless steel, 20 gauge (.95 mm) minimum, solid insert pan for each space, sized per plans, details, and specifications.

2. Where pan sizes are not indicated in plans, details, or specifications, provide one full-size pan to securely fit each opening.
3. Provide a maximum depth pan to suit each application and space allocated for same.
4. Provide 18 gauge (1.27 mm) removable stainless steel adapter bars where applicable.

2.14 TRAY SLIDES

A. Verify the following before fabrication of counters with tray slides:
B. Configuration of all corners, turns and shape of tray slides for proper support and safe guidance of trays.
C. Size and shape of tray to be used in operation.

2.15 ENCLOSURES

A. Provide and install enclosure panels secured or removable as specified for any item which houses equipment with movable parts, i.e. compressors, pumps, etc. Also, cover and provide protection for any exposed steam line or condensate line, which may be within reach of operating personnel.

2.16 DISPENSER (SELF-LEVELING)

A. Verify make of ware, their dimensions, and weight and submit to the dispenser manufacturer at earliest possible date so that springs may be properly calibrated.

2.17 WATER FILTER-PURIFIER

A. Furnish in-line water filter-purifiers to remove materials, taste, and odors from beverage system, coffee urns, and icemakers, manufactured by Everpure or equal. Provide proper size filter - purifier for equipment being supplied. Locate to insure easy access for cartridge replacement.

2.18 ELECTRICAL WORK - GENERAL REQUIREMENTS

A. Before ordering equipment, confirm with the local servicing electric utility supplier, all pertinent electrical requirements such as actual voltages available, number of phases and number of wires in the system.
B. Electrical work for custom fabricated equipment shall be completely wired by this Contractor to a junction or pull box, easily accessible, mounted on the equipment. Wiring shall be labeled for outlet or item served.
C. Components and assemblies shall bear the U.L. label or be approved by the prevailing authority.
D. Provide custom fabricated and standard refrigerated units with vapor tight receptacles, shatterproof lamps and automatic switches. All wiring to be concealed.

2.19 INTERNAL WIRING OF FIXTURES AND EQUIPMENT

A. Contractor shall be responsible for internal wiring of electrical devices, and shall build them into or form them as an integral part of the custom fabricated equipment items. Wiring to be placed in metal conduit to a pull box tagged for intended use. Check with the Owner or Owners representative for color-coding of wiring.
B. Each standard item shipped in sections shall be properly connected internally and verified.
C. Provide dishwashers and conveyors internally wired to junction box or distribution panel as specified, including push button switches, motors, immersion heaters, solenoids, etc.

D. Where light fixtures are specified or detailed as part of counters, cases or fixtures, light fixtures and lamps to be provided unless otherwise specified. If fluorescent light fixtures are specified, all ballasts shall be included.

E. Wiring for built-in strip heaters or immersion-type elements shall be provided as follows:
   1. In heat zone, have U.L. approved insulation and not less than 300 volt rated with nickel wire.
   2. Connection wiring extended in raceway or conduit to junction or pull box shall not be less than 600 volt rated A.V.A. insulation covered wire, U.L. approved, or equal.

F. Wiring for custom fabricated refrigerator and freezer cabinets shall be U.L. approved, insulated cable from exterior junction box to internal components within insulation, unless code requires metallic conduit:
   1. Conduit shall be Electrical Metallic Tubing, rigid or flexible (Greenfield). For freezer applications, Seal Tite Flex or approved equal shall be used.
   2. Internal wiring shall be U.L. approved rubber covered 600 volt rated conductor except door heaters, which shall be nichrome wire with silicone-braided jacket having resistance of 10.4 watts per lineal foot.
   3. Convenience outlets, lighting receptacles (rubber or porcelain), and door switches shall be mounted in approved boxes. Convenience outlets for evaporators shall be twist-lock type. Solid connections as for freezer evaporators shall be made vapor tight.

G. Exposed flexible steel conduit on kitchen equipment shall be neoprene jacketed "Seal-Tite" conduit equal to Anaconda type "UV" U.L. approved, complete with approved liquid-tight connectors on each end, designed to provide electrical grounding continuity.

H. Exposed electrical conduit used in kitchen wet area applications, except for flexible connections, shall be rigid galvanized steel. Thin wall conduit (EMT) will not be permitted for wet areas. Exposed outlet boxes shall be liquid-tight with thread hubs.

2.20 CONVENIENCE AND POWER OUTLETS

A. Make cutouts and install appropriate boxes or outlets in custom fabricated fixtures complete with wiring conduit, outlet and cover plate.

B. All outlets and plugs shall conform to N.E.M.A. standards.

C. All electrical outlets and devices shall be first quality "Specification Grade."

2.21 PLUGS AND CORDS

A. Where cords and plugs are used, they must comply with National Electrical Manufacturer's Association (N.E.M.A.) requirements.

2.22 HEATING EQUIPMENT

A. Electric and heating equipment to be installed so as shall be readily cleanable or easily removable for cleaning.

B. Steam-heated custom fabricated equipment shall be of self-contained assembly complete with control valves located in an accessible position.

2.23 STARTERS, SWITCHES AND CONTROLS

A. Furnish all starters, motor controls, remote controls and transformers as required.

B. Locate all switches out of heat zone.

C. All starters, switches and controls shall have white on black phenolic plastic identification plates with stainless steel screws conspicuously located on adjacent surfaces.

2.24 REFRIGERATION

A. Refrigeration systems shall include start-up and one-year warranty service plus an additional four-year guarantee on all condensing units and compressors. This includes refrigerators, ice cream cabinets, icemakers, freezers, dispensers, and all other refrigerated items.

2.25 COLD PANS

A. Ice pans, refrigerated pans and cabinets to be provided with breaker strips where adjoining top or cabinet face materials, to prevent transfer of cold.

2.26 VENTILATION OF REFRIGERATED EQUIPMENT

A. Adequate air supply and exhaust shall be provided for all self-contained refrigeration condensing units, both custom fabricated and standard, as required for proper operation.
B. If additional ventilation is required to ensure correct operating temperatures, so state in a letter to the Owner or Owners Representative for evaluation and decision before purchase/fabrication.

2.27 COMPONENTS

A. Coils
1. Coils for standard and custom fabricated refrigerators to have vinyl plastic coatings, stainless steel housings and shall be installed in such a manner as to be replaceable.
B. Expansion Valves
1. Standard reach-in refrigerators and freezers, for remote refrigeration systems, shall be complete with thermostatic expansion valves at the evaporator.
C. Thermometers
1. Refrigerated compartments, custom fabricated and standard shall be fitted with flush dial-type thermometers with chrome-plated bezels.
2. Thermometers to be adjustable and shall be calibrated after installation.
3. Thermometers shall have an accuracy of $\pm$ 2°F. (1°C).
D. Hardware
1. Refrigerator hardware for standard and custom fabricated refrigerator compartments shall be solid, heavy-duty components.
E. Hinges shall be self-closing.
F. Latches shall be magnetic edge mount-type unless specified or detailed otherwise.
F. Locks
1. Doors and drawers for reach-in refrigerated compartments, both custom fabricated and standard, to be fitted with cylinder locking type latches, and provided with master keys.

PART 3 - EXECUTION (GENERAL INSTALLATION OF EQUIPMENT)

3.1 TRIMMING AND SEALING OF EQUIPMENT

A. Any space between units to walls, ceilings, floors and adjoining non-portable units shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material suitable to the nature of the equipment and acceptable to Architect.
B. Sealer, when not exposed to extreme heat, shall be silicone construction sealant in appropriate color.
C. Ends of hollow sections shall be closed.

D. Enclosed fixtures without legs mounted on masonry bases or floor shall be sealed watertight to base or floor.

E. Prison or jail installation shall have all openings and crevices, such as but not limited to spaces between sinks and between backsplash and wall, sealed with welded matching metal.

3.2 CUTTING AND FITTING

A. Do all cutting and fitting required on the equipment during installation and hook up. Should any repairs to food service equipment be required due to neglect of other contractors, all extra charges are to be approved and all repairs are to be noted in writing before work is performed, stipulating the price and to whom the extra expense is to be paid. In case this Contractor does not secure such extra order, the expense will be borne by him.

B. No cutting, notching, drilling, or altering of any kind will be done to the building by any Contractor without first obtaining permission from the Owner or Owner's Representative.

3.3 PROTECTION OF EQUIPMENT

A. Contractor will be responsible during the progress of the work to protect equipment against theft and/or damage until final acceptance by the Owner. All items delivered to the job site prior to final acceptance shall be signed for, as delivered, by the Owner. Responsibility for safekeeping will rest with Contractor in coordination with Owner's requirements.

B. Pre-fabricated walk-in boxes, on-site and installed in advance of the rest of the equipment, are not to be used for general storage by other trades and shall be locked by this contractor before leaving the site. It is the Contractor's responsibility to insure proper ventilation is provided during the cleaning and curing of masonry wearing floors inside the walk-in boxes. Damage and/or theft resulting from failure to secure boxes will be repaired/replaced at Contractor's expense.

ITEMIZED EQUIPMENT SPECIFICATIONS

ITEM 1 WALK-IN COOLER
Quantity: One Assembly
Manufacturer: Kolpak
Model No.: Custom 8'0" High

a. Size and configuration as shown on plan and verified site conditions.
b. Foamed in place 4" foam-in-place polyurethane insulation. Insulation to be rigid filled and meet all Class 1 requirements; wall, ceiling and door panels to be R-25 minimum. Panels to be UL & NSF approved.
c. Interior & exterior finish to be manufacturer's standard stucco embossed aluminum with 36" high aluminum tread plate wainscot and extruded bumper rail with vinyl inset on all exposed exterior surfaces. 4" panelized floor with aluminum treadplate overlay / cove base finish and built-in interior ramp as indicated on plans.
d. One 36" x 78" flush type door assembly, hinged as shown on plans, with 36" high aluminum tread plate kick plate on both sides of doors. Provide strip curtains, third hinge, pressure relief port, and thermometer.
e. Vapor proof incandescent light fixtures, quantity as shown on plans and sufficient to provide a minimum of 40 lumens per watt. Provide Weiss Instruments model XWA11V alarm and light manager with temperature alarms, door open alarm and auto-off light switch. Electrical Division to mount, connect and supply lamps and make connections.
f. Trim walk-in assembly to all adjacent building surfaces with matching closure trim.

ITEM 2 COOLER EVAPORATOR COIL
Quantity: LOT – Included in Item #3, Cooler Condensing Unit

ITEM 3 COOLER CONDENSING UNIT
Quantity: One
Manufacturer: Kolpak
Model No.: PR99M / 208V 3Ph

a. Hermetic 404A air-cooled condenser (high side assembly), evaporator coil (low side assembly), solenoid valve, time clock, pressure control, sight glass, liquid-line drier, temperature control, thermostatic expansion valve, vibration isolators, floodback head pressure control, crankcase heater, low ambient controls, weatherproof housing, and all necessary components for a fully functional system.
b. Condensing unit to be equipped with an over-sized receiver large enough to accept the total liquid volume of refrigerant without exceeding 80% of its volumetric capacity at its designed operating temperature and pressure. Receiver to be equipped with a fusible plug and shut-off valve with service ports.
c. Furnish and install condenser unit, evaporator coil, refrigerant lines, insulation, thermo-expansion valves, refrigerant, and accessories as required.
d. Lid mount assembly. Verify exact location with Architect and General Contractor.

ITEM 4 WALK-IN SHELVING
Quantity: Lot
Manufacturer: Metro
Model No.: Metroseal 3

a. Four tiers with 74” posts.

ITEM 5 WALK-IN FREEZER
Quantity: One Assembly
Manufacturer: Kolpak
Model No.: Custom 8’0” High

a. Size and configuration as shown on plan and verified site conditions.
b. Foamed in place 4” foam-in-place polyurethane insulation. Insulation to be rigid filled and meet all Class 1 requirements; wall, ceiling and door panels to be R-32 minimum. Panels to be UL & NSF approved.
c. Interior & exterior finish to be manufacturer’s standard stucco embossed aluminum with 36” high aluminum tread plate wainscot and extruded bumper rail with vinyl inset on all exposed exterior surfaces. 4” panelized floor with aluminum treadplate overlay / cove base finish and built-in interior ramp as indicated on plans.
d. One 36” x 78” flush type door assembly, hinged as shown on plans, with 36” high aluminum tread plate kick plate on both sides of doors. Provide strip curtains, third hinge, pressure relief port, and thermometer.
e. Vapor proof incandescent light fixtures, quantity as shown on plans and sufficient to provide a minimum of 40 lumens per watt. Provide Weiss Instruments model XWA11V alarm and light manager with temperature alarms, door open alarm and auto-off light switch. Electrical Division to mount, connect and supply lamps and make connections.
f. Trim walk-in assembly to all adjacent building surfaces with matching closure trim.

ITEM 6 FREEZER EVAPORATOR COIL
Quantity: LOT – Included in Item #7, Freezer Condensing Unit

ITEM 7 FREEZER CONDENSING UNIT
Quantity: One
Manufacturer: Kolpak
Model No.: PR249L / 208V 3Ph

a. Hermetic 404A air-cooled condenser (high side assembly), evaporator coil (low side assembly), solenoid valve, time clock, pressure control, sight glass, liquid-line drier, temperature control, thermostatic expansion valve, vibration isolators, floodback head pressure control, crankcase heater, low ambient controls, weatherproof housing, and all necessary components for a fully functional system.
b. Condensing unit to be equipped with an over-sized receiver large enough to accept the total liquid volume

of refrigerant without exceeding 80% of its volumetric capacity at its designed operating temperature and pressure. Receiver to be equipped with a fusible plug and shut-off valve with service ports.

c. Furnish and install condenser unit, evaporator coil, refrigerant lines, insulation, thermo-expansion valves, refrigerant, and accessories as required.
d. Outdoor installation on roof near grids NE4 / NEB.4 Verify exact location with Architect and General Contractor.

ITEM 7 SPARE NUMBER

ITEM 8 DUNNAGE RACK
Quantity: Lot
Manufacturer: Metro
Model No.: Super Erecta Brite

a. Removable stainless steel mat.

ITEM 9 STORAGE SHELVING
Quantity: Lot
Manufacturer: Metro
Model No.: Super Erecta Brite

a. Four tiers with 74” posts.

ITEM 10 SPARE NUMBER

ITEM 11 HAND SINK ASSEMBLY
Quantity: Four
Manufacturer: John Boos
Model No.: PBHS-W-1410

a. Side splashes, faucet and basket drain assembly.

ITEM 12 SOAP and TOWEL DISPENSER
Quantity: Four – By Vendor, Not in Foodservice Contract

ITEM 13 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 14 SPARE NUMBER

ITEM 15 PREP TABLE with SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high with die crimped edge, 6” high backsplash, stainless steel undershelf at right drainboard, front crossrail at sinks, and rear / side crossrails only at left drainboard.
b. Two 21” x 24” x 12” deep sinks with heavy duty faucet (10” spout) and two rotary waste assemblies.

ITEM 16 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 17 20 QUART MIXER
Quantity: One
Manufacturer: Hobart
Model No.: HL200 Bench Model
a. Taper hub, stainless steel bowl, batter beater, wire whip, and bowl guard.

ITEM 18 MOBILE MIXER STAND
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 21" high with die-crimped edge, undershelf, utensil tree, and heavy duty casters.

ITEM 19 PAN RACK CART
Quantity: Lot
Manufacturer: New Age
Model No.: 1335
a. Universal angle unit with pan stop, perimeter bumper and lockable casters.

ITEM 20 SPARE NUMBER

ITEM 21 MOBILE WORK TABLE
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34" high to work surface, bullnose edge. Stainless steel undershelf full width. Mobile unit, provide heavy-duty casters, two (2) with brakes.

ITEM 22 DOUGH PRESS
Quantity: One – Existing Equipment, Not in Foodservice Contract.

ITEM 23 SPARE NUMBER

ITEM 24 SPARE NUMBER

ITEM 25 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series
a. See manufacturers shop drawings.
b. Assembly to consist of one 8'-0" x 5'-6" deep section.
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 26 WALL FLASHING
Quantity: Lot
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 20 Ga. stainless steel flashing full height of wall below hood. Extend 18" beyond each end / side of hood.

ITEM 27 CONVEYOR PIZZA OVEN
Quantity: One – Existing Equipment, Not in Foodservice Contract.

ITEM 28 MOBILE HEATED CABINET
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 29 MOBILE WORK TABLE
Quantity: Three
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34" high to work surface, bullnose edge. Stainless steel undershelf full width. Mobile unit, provide heavy-duty casters, two (2) with brakes.

ITEM 30 WORKTOP REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: TWT-60

a. ADA compliant unit with heavy duty casters and heavy duty stainless top.

ITEM 31 FIRE SUPPRESSION SYSTEM
Quantity: One
Manufacturer: Ansul
Model No.: R102

a. Appliance surface, hood protection with remote pull station(s) as required by governing codes, NFPA-96 and U.L. 300, for Exhaust Hoods, Items #25, 32 and 46.
b. Remote pull station(s) and type K fire extinguishers located per local code.
c. Micro switches with two sets of normally open and two sets of normally closed contact points.
d. All piping concealed where possible; exposed piping to be chrome-plated or in stainless steel sleeves.
e. All piping, components and labor necessary for a complete and operable system in accordance with all prevailing codes.
f. Terminal for connection to electric shunt trips / contactors for all electric circuits below hood by Electrical Division.
g. KEC shall provide factory authorized certification of fire protection system upon completion of installation, hook-up and testing.

ITEM 32 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. Assembly to consist of two 11'-0" x 4'-6" deep sections mounted end-to-end. Utility cabinet to include components of fire suppression system, and pre-wired light / fan switches / starters, and indicator lights.
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 33 WALL FLASHING
Quantity: Lot
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 20 Ga. stainless steel flashing full height of wall below hood. Extend 18" beyond each end / side of hood.

ITEM 34 FRYER BATTERY
Quantity: One – Existing Equipment, Not in Foodservice Contract.

ITEM 35 RANGE with OVEN
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 36 CHAR-BROILER
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 37 RANGE with OVEN
Quantity: One
Manufacturer: Garland / US Range
Model No.: M44R
a. 3/4" rear gas connection and gas pressure regulator. Cap and cover both ends of front manifold. Provide one 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and one set of caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.
b. Heavy-duty casters, fixed on rear, swivel with brakes on front, and stainless steel high backguard for mounting of Salamander, item #38.

ITEM 38 SALAMANDER BROILER
Quantity: One
Manufacturer: Garland / US Range
Model No.: MIR-34L
a. Stainless steel top and bottom, wall mount brackets and interconnecting gas piping for range mount.

ITEM 39 CONVECTION OVEN
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 40 WORKTOP FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: TWT-60F
a. ADA compliant unit with heavy duty casters and heavy duty stainless top.

ITEM 41 CONVECTION STEAMER
Quantity: One
Manufacturer: Cleveland Range
Model No.: 24-CGA-10
a. Gas pressure regulator, Claris CWT-06 water filter assembly, compartment door steam shut-off switch, and drain line tempering kit.

ITEM 42 WATER FILTER ASSEMBLY
Quantity: One – Included with Item #41.

ITEM 43 SPARE NUMBER

ITEM 44 SPARE NUMBER

ITEM 45 POPCORN POPPER
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 46 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. Assembly to consist of one 7'-6" x 4'-0" deep section
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 47 SPARE NUMBER

ITEM 48 SPARE NUMBER

ITEM 49 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 50 SPARE NUMBER

ITEM 51 SOILED DISHTABLE
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34" high to work surface with raised roll edge, 12" high backsplash, and open base construction.
b. 4" wide x 2" deep quick drain assembly with removable strainer basket.
c. Fisher Model No.2210-WB pre-rinse assembly.

ITEM 52 COLLECTOR ASSEMBLY
Quantity: One
Manufacturer: Salvajor
Model No.: S419 (208V 3Ph)

a. SS-33 control panel with remote MSS-LD controls, remote start-stop, appropriate mounting brackets and stainless steel cover.

ITEM 53 PRE-RINSE ASSEMBLY
Quantity: One – Included with Item #51.

ITEM 54 CONDENSATE HOOD
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 36" x 36" x 18" high, with 9" x 9" collar.

b. 18 Ga. stainless steel construction, fully welded at gutter corners, spot welded and sealed on vertical corners and top.
c. 3/8" S/S hanger rods as necessary to mount unit at 7'-6" A.F.F. to bottom of hood. Hood to be hung by KEC, connected by Division 15.
d. Provide closure panels to finished ceiling as necessary.

ITEM 55 DISHMACHINE
Quantity: One
Manufacturer: Hobart
Model No.: AM15T
a. 208V / 3Ph unit with electric tank heat, integral booster heater, drain line tempering kit, pressure regulator valve and single point electrical connection.
b. Provide with #SEF-8100 factory mounted and wired single point connection.
c. Corner operation with tall chamber and splash shield.

ITEM 56 CLEAN DISHTABLE
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34" high to work surface with raised roll edge, 12" high backsplash, undershelf full width.

ITEM 57 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 2" high turn up at walls, bullnose edge, 14 Ga. s/s brackets at 36" on center max.

ITEM 58 SPARE NUMBER

ITEM 59 POT & PAN SHELVING
Quantity: Lot
Manufacturer: Metro
Model No.: Metroseal 3
a. Four tiers with 74" posts.

ITEM 60 SPARE NUMBER

ITEM 61 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34" high to work surface with raised roll edge, 12" high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21" x 27" x 15" deep sinks. Two heavy duty faucets with 12" spouts and three rotary waste assemblies.

ITEM 62 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 2" high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36" on center (max).

ITEM 63 SPARE NUMBER

ITEM 64 SPARE NUMBER

ITEM 65 SPARE NUMBER

ITEM 66 SPARE NUMBER

ITEM 67 SPARE NUMBER

ITEM 68 SPARE NUMBER

ITEM 69 CLOTHES WASHER
Quantity: One – By Owner, Not in Foodservice Contract

ITEM 70 SPARE NUMBER

ITEM 71 SPARE NUMBER

ITEM 72 SPARE NUMBER

ITEM 73 SPARE NUMBER

ITEM 74 SPARE NUMBER

ITEM 75 SPARE NUMBER

ITEMS 75-100 SPARE NUMBERS

ITEM 101 ICE MAKER
Quantity: One
Manufacturer: Manitowoc
Model No.: SY-0454A
a. 120V / 1Ph unit with Arctic AR-1000 water filter.

ITEM 102 ICE BIN
Quantity: One
Manufacturer: Manitowoc
Model No.: B-570

ITEM 103 WATER FILTER ASSEMBLY
Quantity: One – Included with Item #101

ITEM 104 STORAGE SHELVING
Quantity: Lot
Manufacturer: Metro
Model No.: Super Erecta Brite
a. Four tiers with 74” posts.

ITEM 105 DESK
Quantity: One – By Owner, Not in Foodservice Contract

ITEM 106 SODA SYSTEM and RACK
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 107 SPARE NUMBER

ITEM 108 HAND SINK ASSEMBLY
Quantity: One
Manufacturer: John Boos
Model No.: PBHS-W-1410
a. Side splashes, faucet and basket drain assembly.

ITEM 109 SOAP and TOWEL DISPENSER
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 110 SPARE NUMBER

ITEM 111 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high to work surface with raised roll edge, 12” high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21” x 27” x 15” deep sinks. Two heavy duty faucets with 12” spouts and three rotary waste assemblies.

ITEM 112 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 113 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 114 GREASE TRAP
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 115 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 116 SPARE NUMBER

ITEM 117 REFRIGERATED SANDWICH UNIT
Quantity: One
Manufacturer: True
Model No.: TSSU-48-12-ADA
a. ADA compliant unit.

ITEM 118 REACH-IN FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: T-23F
a. Full height doors hinged as shown on plan.

ITEM 119 REACH-IN REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: T-23

a. Full height doors hinged as shown on plan.

ITEM 120 SPARE NUMBER

ITEM 121 FIRE SUPPRESSION SYSTEM
Quantity: One
Manufacturer: Ansul
Model No.: R102

a. Appliance surface and hood protection as required by governing codes, NFPA-96 and U.L. 300, for Exhaust Hood, Item #122.
b. Remote pull station(s) and type K fire extinguishers located per local code.
c. Micro switches with two sets of normally open and two sets of normally closed contact points.
d. All piping concealed where possible; exposed piping to be chrome-plated or in stainless steel sleeves.
e. All piping, components and labor necessary for a complete and operable system in accordance with all prevailing codes.
f. Terminal for connection to electric shunt trips / contactors for all electric circuits below hood by Electrical Division.
g. KEC shall provide factory authorized certification of fire protection system upon completion of installation, hook-up and testing.

ITEM 122 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. Assembly to consist of one 7'-6" x 4'-6" deep section
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 123 WALL FLASHING
Quantity: Lot
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 20 Ga. stainless steel flashing full height of wall below hood. Extend 18" beyond each end / side of hood.

ITEM 124 RANGE with OVEN
Quantity: One
Manufacturer: Garland / US Range
Model No.: M44R

a. 3/4" rear gas connection and gas pressure regulator. Cap and cover both ends of front manifold. Provide one 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and one set of caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.
b. Heavy-duty casters, fixed on rear, swivel with brakes on front, and stainless steel high backguard for

mounting of Salamander, item #38.

ITEM 125 CONVECTION OVEN
Quantity: Two
Manufacturer: Garland / US Range
Model No.: MCO-GS-20-S

a. Double stack unit with stainless steel front, sides and top. Provide gas pressure regulator, and factory manifold between decks. Heavy-duty casters, fixed on rear, swivel with brakes on front.
b. 1" rear, single point gas connection. Provide one 48" long Dormont Posi-Set kit. Kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and one set of caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.

ITEM 126 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. Assembly to consist of one 7'-6" x 4'-6" deep section
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 127 REFRIGERATED EQUIPMENT STAND
Quantity: One
Manufacturer: True Food Service
Model No.: TRCB-36

ITEM 128 GRIDDLE
Quantity: One
Manufacturer: Garland / US Range
Model No.: GTGG36-G36

a. 3/4" rear gas connection and gas pressure regulator. Provide one 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and one set of caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.

ITEM 129 FRYER ASSEMBLY
Quantity: One Assembly
Manufacturer: Dean
Model No.: HD50G / UFF Filter

a. Assembly to consist of, from right to left, two fryers and one dump station with rod style food warmer, all on a common frame assembly.
b. Provide common manifold to single point 1" gas connection with gas pressure regulator. Provide 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.
c. Heavy-duty casters, fixed on rear, swivel with brakes on front.

ITEM 130 SPARE NUMBER

ITEM 131 BACK COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.

ITEM 132 UNDERCOUNTER FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: TUC-27F
a. Provide with low profile casters for installation below Back counter, Item #131.

ITEM 133 PRETZEL WARMER
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 134 POPCORN POPPER
Quantity: One
Manufacturer: Gold Medal
Model No.: 2003
a. Heavy duty cord and plug

ITEM 135 HOT DOG ROLLER GRILL
Quantity: One
Manufacturer: APW Wyott
Model No.: HRS-31
a. 208V model with Tru-Turn rollers and 4” legs.
b. Stainless steel finish.

ITEM 136 HEATED DRAWERS
Quantity: Four
Manufacturer: APW Wyott
Model No.: BC-31

ITEM 137 SPARE NUMBER

ITEM 138 SPARE NUMBER

ITEM 139 REFRIGERATED PREP TABLE
Quantity: One
Manufacturer: True Food Service
Model No.: TSSU-60-8
a. ADA compliant unit.

ITEM 140 SPARE NUMBER

ITEM 141 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.
b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 142 STAINLESS STEEL CHASE
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. Extend from finish ceiling to top of front serving counter. Verify sizing with beverage line bundles.
b. 16 Ga. stainless steel.

ITEM 143 SNEEZEGUARD
Quantity: Three
Manufacturer: Brass Smith
Model No.: ZG9600
a. 48” long portable market guard with brushed aluminum framework and 1/4” glass with 1” radius corners. Provide end panels, both ends.

ITEM 144 SODA DISPENSER with ICE BIN
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 145 CUP DISPENSER MODULE
Quantity: Three
Manufacturer: Dispense-Rite.
Model No.: WR-CC-22
a. Mount to face of vendor supplied soda dispensers.

ITEM 146 HEATED DRAWERS
Quantity: Four
Manufacturer: APW Wyott
Model No.: HDD-2
a. Provide 3-1/2” casters, (2) with brakes and heavy duty cord and plug.

ITEM 147 POS EQUIPMENT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 148 REFRIGERATED COLD PAN
Quantity: One
Manufacturer: Delfield
Model No.: N8131-FA
a. Build into Item #141, Front Counter.

ITEM 149 INDUCTION WARMER
Quantity: Four
Manufacturer: Cook Tek
Model No.: MB061-U
a. Undercounter mount below Front Buffet Counter, Item #491 as indicated on plans. Coordinate all installation requirements with Architect and Millwork Contractor.
b. Heavy duty cord and plug; coordinate NEMA configuration with Electrical Division.

ITEM 150 BUFFET TABLE
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 151 WALK-IN COOLER
Quantity: One Assembly
Manufacturer: Kolpak
Model No.: Custom 8'0" High

a. Size and configuration as shown on plan and verified site conditions.
b. Foamed in place 4" foam-in-place polyurethane insulation. Insulation to be rigid filled and meet all Class 1 requirements; wall, ceiling and door panels to be R-25 minimum. Panels to be UL & NSF approved.
c. Interior & exterior finish to be manufacturer's standard stucco embossed aluminum with 36" high aluminum tread plate wainscot and extruded bumper rail with vinyl inset on all exposed exterior surfaces. 4" panelized floor with aluminum treadplate overlay / cove base finish and built-in interior ramp as indicated on plans.
d. One 36" x 78" flush type door assembly, hinged as shown on plans, with 36" high aluminum tread plate kick plate on both sides of doors. Provide strip curtains, third hinge, pressure relief port, and thermometer.
e. Vapor proof incandescent light fixtures, quantity as shown on plans and sufficient to provide a minimum of 40 lumens per watt. Provide Weiss Instruments model XWA11V alarm and light manager with temperature alarms, door open alarm and auto-off light switch. Electrical Division to mount, connect and supply lamps and make connections.
f. Trim walk-in assembly to all adjacent building surfaces with matching closure trim.

ITEM 152 COOLER EVAPORATOR COIL
Quantity: LOT – Included in Item #153, Cooler Condensing Unit

ITEM 153 COOLER CONDENSING UNIT
Quantity: One
Manufacturer: Kolpak
Model No.: PR99M / 208V 3Ph

a. Hermetic 404A air-cooled condenser (high side assembly), evaporator coil (low side assembly), solenoid valve, time clock, pressure control, sight glass, liquid-line drier, temperature control, thermostatic expansion valve, vibration isolators, floodback head pressure control, crankcase heater, low ambient controls, weatherproof housing, and all necessary components for a fully functional system.
b. Condensing unit to be equipped with an over-sized receiver large enough to accept the total liquid volume of refrigerant without exceeding 80% of its volumetric capacity at its designed operating temperature and pressure. Receiver to be equipped with a fusible plug and shut-off valve with service ports.
c. Furnish and install condenser unit, evaporator coil, refrigerant lines, insulation, thermo-expansion valves, refrigerant, and accessories as required.
d. Lid mount assembly. Verify exact location with Architect and General Contractor.

ITEM 154 WALK-IN SHELVING
Quantity: Lot
Manufacturer: Metro
Model No.: Metroseal 3

a. Four tiers with 74" posts.

ITEM 155 SPARE NUMBER

ITEM 156 SODA SYSTEM and RACK
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 157 SPARE NUMBER

ITEM 158 HAND SINK ASSEMBLY
Quantity: Two
Manufacturer: John Boos
Model No.: PBHS-W-1410

a. Side splashes, faucet and basket drain assembly.

ITEM 159 SOAP and TOWEL DISPENSER
Quantity: Four – By Vendor, Not in Foodservice Contract

ITEM 160 SPARE NUMBER

ITEM 161 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high to work surface with raised roll edge, 12” high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21” x 27” x 15” deep sinks. Two heavy duty faucets with 12” spouts and three rotary waste assemblies.

ITEM 162 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 163 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 164 GREASE TRAP
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 165 SPARE NUMBER

ITEM 166 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 167 ICE MAKER
Quantity: One
Manufacturer: Manitowoc
Model No.: SY-0454A

a. 120V / 1Ph unit with Arctic AR-1000 water filter.

ITEM 168 ICE BIN
Quantity: One
Manufacturer: Manitowoc
Model No.: B-570

ITEM 169 WATER FILTER ASSEMBLY
Quantity: One – Included with Item #167

ITEM 170 BACK COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34" high work surface with square turn-down edge, 4" x 1" backsplash, intermediate shelf and sliding doors full width of counter.

ITEM 171 FIRE SUPPRESSION SYSTEM
Quantity: One
Manufacturer: Ansul
Model No.: R102

a. Appliance surface and hood protection as required by governing codes, NFPA-96 and U.L. 300, for Exhaust Hood, Item #172.
b. Remote pull station(s) and type K fire extinguishers located per local code.
c. Micro switches with two sets of normally open and two sets of normally closed contact points.
d. All piping concealed where possible; exposed piping to be chrome-plated or in stainless steel sleeves.
e. All piping, components and labor necessary for a complete and operable system in accordance with all prevailing codes.
f. Terminal for connection to electric shunt trips / contactors for all electric circuits below hood by Electrical Division.
g. KEC shall provide factory authorized certification of fire protection system upon completion of installation, hook-up and testing.

ITEM 172 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. Assembly to consist of one 6'-6" x 4'-6" deep section
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 173 WALL FLASHING
Quantity: Lot
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 20 Ga. stainless steel flashing full height of wall below hood. Extend 18" beyond each end / side of hood.

ITEM 174 FRYER ASSEMBLY
Quantity: One Assembly
Manufacturer: Dean
Model No.: HD50G / UFF Filter

a. Assembly to consist of, from left to right, four fryers and one dump station with rod style food warmer, all on a common frame assembly.
b. Provide common manifold to single point 1" gas connection with gas pressure regulator. Provide 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.

c. Heavy-duty casters, fixed on rear, swivel with brakes on front.

ITEM 175 REACH-IN FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: T-23F
a. Full height doors hinged as shown on plan.

ITEM 176 WORKTOP REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: TWT-48
a. ADA compliant unit with heavy duty casters and heavy duty stainless top.

ITEM 177 REFRIGERATED SANDWICH UNIT
Quantity: One
Manufacturer: True
Model No.: TSSU-48-12-ADA
a. ADA compliant unit.

ITEM 178 SPARE NUMBER

ITEM 179 REACH-IN REFRIGERATOR
Quantity: Two - By Vendor, Not in Foodservice Contract

ITEM 180 BACK COUNTER with HAND SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.
b. Heavy duty faucet with 10” spout and one rotary waste assembly.

ITEM 181 BACK COUNTER with HAND SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.
b. Heavy duty faucet with 10” spout and one rotary waste assembly.

ITEM 182 PRETZEL WARMER
Quantity: Three – By Vendor, Not in Foodservice Contract

ITEM 183 POPCORN POPPER
Quantity: Three
Manufacturer: Gold Medal
Model No.: 2003
a. Heavy duty cord and plug

ITEM 184 PIZZA DISPLAY/WARMER
Quantity: One
Manufacturer: Hatco

Model No.: FDWD-1
a. 4” adjustable legs

ITEM 185 CHEESE WARMER
Quantity: Three – By Vendor, Not in Foodservice Contract

ITEM 186 CHILI WARMER
Quantity: Three – By Vendor, Not in Foodservice Contract

ITEM 187 HOT DOG ROLLER GRILL
Quantity: One
Manufacturer: APW Wyott
Model No.: HRS-50
a. 208V model with Tru-Turn rollers and 4” legs.
b. Stainless steel finish.

ITEM 188 HEATED DRAWERS
Quantity: Four
Manufacturer: APW Wyott
Model No.: BC-50

ITEM 189 SANDWICH SLIDE
Quantity: Two
Manufacturer: APW Wyott
Model No.: DMXD-36H
a. Stainless / black finish.

ITEM 190 SPARE NUMBER

ITEM 191 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.
b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 192 SPARE NUMBER

ITEM 193 SPARE NUMBER

ITEM 194 SODA DISPENSER with ICE BIN
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 195 CUP DISPENSER MODULE
Quantity: Five
Manufacturer: Dispense-Rite.
Model No.: WR-CC-22
Mount to face of vendor supplied soda dispensers.

ITEM 196 HEATED DRAWERS
Quantity: Eight
Manufacturer: APW Wyott

Model No.: HDD-2

a. Provide 3-1/2" casters, (2) with brakes and heavy duty cord and plug.

ITEM 197 POS EQUIPMENT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 198 SPARE NUMBER

ITEM 199 SPARE NUMBER

ITEM 200 SPARE NUMBER

ITEM 201 COFFEE BREWER
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 202 HOT CHOCOLATE DISPENSER
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 203 SPARE NUMBER

ITEM 204 SPARE NUMBER

ITEM 205 ICE CREAM CABINET
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 206 SPARE NUMBER

ITEM 207 SPARE NUMBER

ITEM 208 SPARE NUMBER

ITEM 209 DESK
Quantity: One – By Owner, Not in Foodservice Contract

ITEM 210 SPARE NUMBER

ITEM 211 SPARE NUMBER

ITEM 212 SPARE NUMBER

ITEM 213 SPARE NUMBER

ITEM 214 SPARE NUMBER

ITEM 215 SPARE NUMBER

ITEM 216 SPARE NUMBER

ITEM 217 SPARE NUMBER

ITEM 218 SPARE NUMBER

ITEM 219 SPARE NUMBER

ITEM 220 SPARE NUMBER

ITEM 221 SPARE NUMBER

ITEM 222 SPARE NUMBER

ITEM 223 SPARE NUMBER

ITEM 224 SPARE NUMBER

ITEM 225 SPARE NUMBER

ITEM 226 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high to work surface with raised roll edge, 12” high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21” x 27” x 15” deep sinks. Two heavy duty faucets with 12” spouts and three rotary waste assemblies.

ITEM 227 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 228 GREASE TRAP
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 229 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 230 SPARE NUMBER

ITEM 231 WORK COUNTER with SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with 6” backsplash, and intermediate shelf.
b. Heavy duty faucet with 10” spout and one rotary waste assembly.

ITEM 232 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 233 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 234 CONVECTION STEAMER
Quantity: One

Manufacturer: Cleveland Range Inc.
Model No.: 21CET8
a. 208/3 three 12" x 20" x 2-1/2" pan capacity.
b. Right hand door hinging, 4" high legs, and compartment door steam shut-off switch.

ITEM 235 WATER FILTER ASSEMBLY
Quantity: One – Included with Item #234

ITEM 236 COFFEE BREWER
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 237 POS EQUIPMENT
Quantity: Lot – By Owner, Not in Foodservice Contract

ITEM 238 SPARE NUMBER

ITEM 239 REACH-IN REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: T-48
a. Full height doors hinged as shown on plan.

ITEM 240 SPARE NUMBER

ITEM 241 HAND SINK ASSEMBLY
Quantity: One
Manufacturer: John Boos
Model No.: PBHS-W-1410
a. Side splashes, faucet and basket drain assembly.

ITEM 242 SOAP and TOWEL DISPENSER
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 243 STORAGE SHELVING
Quantity: Lot
Manufacturer: Metro
Model No.: Super Erecta Brite
a. Four tiers with 74" posts.

ITEM 244 SPARE NUMBER

ITEM 245 ICE MAKER
Quantity: One
Manufacturer: Manitowoc
Model No.: SY-0454A
a. 120V / 1Ph unit with Arctic AR-1000 water filter.

ITEM 246 ICE BIN
Quantity: One
Manufacturer: Manitowoc
Model No.: B-570

ITEM 247 WATER FILTER ASSEMBLY
Quantity: One – Included with Item #245

ITEM 248 SPARE NUMBER

ITEM 249 BUFFET COUNTER
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 250 MOBILE BAR UNIT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEMS 251-300 SPARE NUMBERS (To Be Determined at a Later Date)

ITEM 301 KEG COOLER
Quantity: One
Manufacturer: Perlick Corporation
Model No.: US10KP-L

a. Self-contained.
b. Keg shelf.
c. Extended warranty (5 Yr. compressor only)

ITEM 302 BEER SYSTEM
Quantity: One
Manufacturer: Perlick Corporation
Model No.: 4414

a. Trunk housing with copper coolant lines
b. Provide regulators, blend gas compatible components, rotating probe coupler, top assemblies and all components, parts, and fittings necessary for a complete and operable system.
c. System pre-wired for BLM components
d. Extended warranties

ITEM 303 SODA SYSTEM and RACK
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 304 SPARE NUMBER

ITEM 305 3 COMPARTMENT SINK
Quantity: One
Manufacturer: Perlick Corporation
Model No.: TSD53C

a. Gooseneck faucet, and 14” drainboards each side.
b. Stainless steel construction

ITEM 306 SPARE NUMBER

ITEM 307 SPARE NUMBER

ITEM 308 SPARE NUMBER

ITEM 309 SPARE NUMBER

ITEM 310 SPARE NUMBER

ITEM 311 BACK COUNTER with HAND SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.
b. Heavy duty faucet with 10” spout and one rotary waste assembly.

ITEM 312 SOAP and TOWEL DISPENSER
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 313 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 314 SPARE NUMBER

ITEM 315 COCKTAIL STATION
Quantity: Three
Manufacturer: Perlick Corporation
Model No.: TSD36IC8

a. 8-circuit sealed-in cold plate & ABS top ledge
b. Stainless steel construction
c. Bottle wells, speed rail and backsplash cut-out for soda lines.

ITEM 316 SODA DISPENSING GUN
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 317 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 318 REACH-IN REFRIGERATOR
Quantity: One
Manufacturer: True
Model No.: GDM-45

ITEM 319 BACK COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.

ITEM 320 SPARE NUMBER

ITEM 321 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.

b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 322 SPARE NUMBER

ITEM 323 BEER TOWER W/DRAINER
Quantity: Two
Manufacturer: Perlick Corporation
Model No.: 3780-6BPC
a. Polished chrome tower with matching top mount drainer and faucet locks.
b. NSF faucet listing.

ITEM 324 SPARE NUMBER

ITEM 325 CUP DISPENSER MODULE
Quantity: Two
Manufacturer: Dispense-Rite.
Model No.: WR-CC-22
a. Mount to face of front counter.

ITEM 324 SPARE NUMBER

ITEM 325 POS EQUIPMENT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 326 SPARE NUMBER

ITEM 327 SPARE NUMBER

ITEM 328 SPARE NUMBER

ITEM 329 SPARE NUMBER

ITEM 330-350 SPARE NUMBERS

ITEM 351 REACH-IN FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: T-43F
a. Full height doors hinged as shown on plan.

ITEM 352 DESK
Quantity: One – By Owner, Not in Foodservice Contract

ITEM 353 SPARE NUMBER

ITEM 354 SODA SYSTEM and RACK
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 355 SPARE NUMBER

ITEM 356 SPARE NUMBER

ITEM 357 PAN RACK CART
Quantity: One
Manufacturer: New Age
Model No.: 1335
a. Universal angle unit with pan stop, perimeter bumper and lockable casters.

ITEM 358 HAND SINK ASSEMBLY
Quantity: One
Manufacturer: John Boos
Model No.: PBHS-W-1410
a. Side splashes, faucet and basket drain assembly.

ITEM 359 SOAP and TOWEL DISPENSER
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 360 SPARE NUMBER

ITEM 361 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high to work surface with raised roll edge, 12” high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21” x 27” x 15” deep sinks. Two heavy duty faucets with 12” spouts and three rotary waste assemblies.

ITEM 362 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 363 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 364 GREASE TRAP
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 365 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 366 SPARE NUMBER

ITEM 367 SPARE NUMBER

ITEM 368 REFRIGERATED SANDWICH UNIT
Quantity: One
Manufacturer: True
Model No.: TSSU-48-12-ADA
a. ADA compliant unit.

ITEM 369 WORKTOP FREEZER
Quantity: One

Manufacturer: True Food Service
Model No.: TWT-27F

a. ADA compliant unit with heavy duty casters and heavy duty stainless top.

ITEM 370 SPARE NUMBER

ITEM 371 FIRE SUPPRESSION SYSTEM
Quantity: One
Manufacturer: Ansul
Model No.: R102

a. Appliance surface and hood protection as required by governing codes, NFPA-96 and U.L. 300, for Exhaust Hood, Item #372.
b. Remote pull station(s) and type K fire extinguishers located per local code.
c. Micro switches with two sets of normally open and two sets of normally closed contact points.
d. All piping concealed where possible; exposed piping to be chrome-plated or in stainless steel sleeves.
e. All piping, components and labor necessary for a complete and operable system in accordance with all prevailing codes.
f. Terminal for connection to electric shunt trips / contactors for all electric circuits below hood by Electrical Division.
g. KEC shall provide factory authorized certification of fire protection system upon completion of installation, hook-up and testing.

ITEM 372 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
c. 3” air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
d. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6’-8” A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 373 WALL FLASHING
Quantity: Lot
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 20 Ga. stainless steel flashing full height of wall below hood. Extend 18” beyond each end / side of hood.

ITEM 374 FRYER ASSEMBLY
Quantity: One Assembly
Manufacturer: Dean
Model No.: HD50G / UFF Filter

a. Assembly to consist of, from left to right, two fryers and one dump station with rod style food warmer, all on a common frame assembly.
b. Provide common manifold to single point 1” gas connection with gas pressure regulator. Provide 48” long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.
c. Heavy-duty casters, fixed on rear, swivel with brakes on front.

ITEM 375 GRIDDLE
Quantity: One
Manufacturer: Garland / US Range
Model No.: GTGG36-G36

a. 3/4" rear gas connection and gas pressure regulator. Provide one 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and one set of caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.

ITEM 376 REFRIGERATED EQUIPMENT STAND
Quantity: One
Manufacturer: True Food Service
Model No.: TRCB-36

ITEM 377 SPARE NUMBER

ITEM 378 UNDERCOUNTER FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: TUC-27F

a. Provide with low profile casters for installation below Back counter.

ITEM 379 REACH-IN REFRIGERATOR
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 380 SPARE NUMBER

ITEM 381 BACK COUNTER with HAND SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34" high work surface with square turn-down edge, 4" x 1" backsplash, intermediate shelf and sliding doors full width of counter.
b. Heavy duty faucet with 10" spout and one rotary waste assembly.

ITEM 382 SANDWICH SLIDE
Quantity: Two
Manufacturer: APW Wyott
Model No.: DMXD-36H

a. Stainless / black finish.

ITEM 383 SPARE NUMBER

ITEM 384 SPARE NUMBER

ITEM 385 SPARE NUMBER

ITEM 386 SPARE NUMBER

ITEM 387 SPARE NUMBER

ITEM 388 SPARE NUMBER

ITEM 389 BACK COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.

ITEM 390 SPARE NUMBER

ITEM 391 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.
b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 392 STAINLESS STEEL CHASE
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. Extend from finish ceiling to top of front serving counter. Verify sizing with beverage line bundles.
b. 16 Ga. stainless steel.

ITEM 393 SPARE NUMBER

ITEM 394 SODA DISPENSER with ICE BIN
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 395 CUP DISPENSER MODULE
Quantity: Two
Manufacturer: Dispense-Rite.
Model No.: WR-CC-22

a. Mount to face of vendor supplied soda dispensers.

ITEM 396 HEATED DRAWERS
Quantity: Four
Manufacturer: APW Wyott
Model No.: HDD-2

a. Provide 3-1/2” casters, (2) with brakes and heavy duty cord and plug.

ITEM 397 POS EQUIPMENT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 398 SPARE NUMBER

ITEM 399 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.
b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 400 SPARE NUMBER

ITEM 401 SPARE NUMBER

ITEM 402 DESK
Quantity: One – By Owner, Not in Foodservice Contract

ITEM 403 SPARE NUMBER

ITEM 404 SODA SYSTEM and RACK
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 405 SPARE NUMBER

ITEM 406 SPARE NUMBER

ITEM 407 MOBILE HEATED CABINET
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 408 HAND SINK ASSEMBLY
Quantity: One
Manufacturer: John Boos
Model No.: PBHS-W-1410
a. Side splashes, faucet and basket drain assembly.

ITEM 409 SOAP and TOWEL DISPENSER
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 410 SPARE NUMBER

ITEM 411 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high to work surface with raised roll edge, 12” high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21” x 27” x 15” deep sinks. Two heavy duty faucets with 12” spouts and three rotary waste assemblies.

ITEM 412 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 2” high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36” on center (max).

ITEM 413 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 414 GREASE TRAP
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 415 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 416 SPARE NUMBER

ITEM 417 ICE MAKER
Quantity: One
Manufacturer: Manitowoc
Model No.: SY-0454A
a. 120V / 1Ph unit with Arctic AR-1000 water filter.

ITEM 418 ICE BIN
Quantity: One
Manufacturer: Manitowoc
Model No.: B-570

ITEM 419 WATER FILTER ASSEMBLY
Quantity: One – Included with Item #417

ITEM 420 SPARE NUMBER

ITEM 421 REACH-IN REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: T-23
a. Full height doors hinged as shown on plan.

ITEM 422 SPARE NUMBER

ITEM 423 SPARE NUMBER

ITEM 424 SPARE NUMBER

ITEM 425 SPARE NUMBER

ITEM 426 COFFEE BREWER
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 427 HOT CHOCOLATE DISPENSER
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 428 UNDERCOUNTER REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: TUC-48
a. Provide with low profile casters for installation below Back counter.

ITEM 429 REACH-IN REFRIGERATOR
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 430 SPARE NUMBER

ITEM 431 BACK COUNTER with HAND SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edge, 4” x 1” backsplash, intermediate shelf and sliding doors full width of counter.
b. Heavy duty faucet with 10” spout and one rotary waste assembly.

ITEM 432 PRETZEL WARMER
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 433 POPCORN POPPER
Quantity: Two
Manufacturer: Gold Medal
Model No.: 2003
a. Heavy duty cord and plug

ITEM 434 PIZZA DISPLAY/WARMER
Quantity: One
Manufacturer: Hatco
Model No.: FDWD-1
a. 4” adjustable legs

ITEM 435 CHEESE WARMER
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 436 CHILI WARMER
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 437 HOT DOG ROLLER GRILL
Quantity: One
Manufacturer: APW Wyott
Model No.: HRS-50
a. 208V model with Tru-Turn rollers and 4” legs.
b. Stainless steel finish.

ITEM 438 HEATED DRAWERS
Quantity: One
Manufacturer: APW Wyott
Model No.: BC-50

ITEM 439 ICE CREAM CABINET
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 440 SPARE NUMBER

ITEM 441 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.
b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 442 SPARE NUMBER

ITEM 443 SPARE NUMBER

ITEM 444 SODA DISPENSER with ICE BIN
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 445 CUP DISPENSER MODULE
Quantity: Two
Manufacturer: Dispense-Rite.
Model No.: WR-CC-22
a. Mount to face of vendor supplied soda dispensers.

ITEM 446 HEATED DRAWERS
Quantity: Four
Manufacturer: APW Wyott
Model No.: HDD-2
a. Provide 3-1/2" casters, (2) with brakes and heavy duty cord and plug.

ITEM 447 POS EQUIPMENT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 448 SPARE NUMBER

ITEM 449 SPARE NUMBER

ITEM 450 SPARE NUMBER

ITEM 451 REACH-IN FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: T-43F
a. Full height doors hinged as shown on plan.

ITEM 452 SPARE NUMBER

ITEM 453 SPARE NUMBER

ITEM 454 SODA SYSTEM and RACK
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 455 SPARE NUMBER

ITEM 456 SPARE NUMBER

ITEM 457 MOBILE HEATED CABINET
Quantity: Lot – Existing Equipment, Not in Foodservice Contract.

ITEM 458 HAND SINK ASSEMBLY
Quantity: One
Manufacturer: John Boos
Model No.: PBHS-W-1410
a. Side splashes, faucet and basket drain assembly.

ITEM 459 SOAP and TOWEL DISPENSER
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 460 SPARE NUMBER

ITEM 461 POT SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34" high to work surface with raised roll edge, 12" high backsplash, open below left drainboard, front rail only below sinks, stainless steel undershelf below right drainboard.
b. Three 21" x 27" x 15" deep sinks. Two heavy duty faucets with 12" spouts and three rotary waste assemblies.

ITEM 462 WALL SHELF
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 2" high turn up at walls, bullnose edge, 14 Ga. stainless steel flag brackets at 36" on center (max).

ITEM 463 TRASH RECEPTACLE
Quantity: Lot – By Owner / Operator, Not in Foodservice Contract

ITEM 464 GREASE TRAP
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 465 MOP SINK ASSEMBLY
Quantity: Lot – By Plumbing Division, Not in Foodservice Contract

ITEM 466 SPARE NUMBER

ITEM 467 SPARE NUMBER

ITEM 468 SPARE NUMBER

ITEM 469 ICE CREAM CABINET
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 470 SPARE NUMBER

ITEM 471 FIRE SUPPRESSION SYSTEM
Quantity: One
Manufacturer: Ansul
Model No.: R102

a. Appliance surface and hood protection as required by governing codes, NFPA-96 and U.L. 300, for Exhaust Hood, Item #472.
b. Remote pull station(s) and type K fire extinguishers located per local code.
c. Micro switches with two sets of normally open and two sets of normally closed contact points.
d. All piping concealed where possible; exposed piping to be chrome-plated or in stainless steel sleeves.
e. All piping, components and labor necessary for a complete and operable system in accordance with all prevailing codes.
f. Terminal for connection to electric shunt trips / contactors for all electric circuits below hood by Electrical Division.

g. KEC shall provide factory authorized certification of fire protection system upon completion of installation, hook-up and testing.

ITEM 472 EXHAUST HOOD ASSEMBLY
Quantity: One
Manufacturer: Captive Aire
Model No.: ND-2 Series

a. See manufacturers shop drawings.
b. Assembly to consist of one 7'-6" x 4'-6" deep section
c. UL/ULC, NSF and NFPA-96 approved, External welded 18 ga. stainless steel construction where exposed, ground and polished. Fully welded duct collars with factory-installed air volume balancing damper(s) and adjustable temperature sensor / switch with timer.
d. 3" air space at all wall locations, concealed grease trough pitched to a removable grease cup, and UL Listed vapor proof incandescent globe light fixtures.
e. Provide stainless steel closure panels above hood to finished ceiling. Mounting height to bottom edge of hood to be 6'-8" A.F.F. Provide all hangers, supports and accessories required for installation.

ITEM 473 WALL FLASHING
Quantity: Lot
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 20 Ga. stainless steel flashing full height of wall below hood. Extend 18" beyond each end / side of hood.

ITEM 474 FRYER ASSEMBLY
Quantity: One Assembly
Manufacturer: Dean
Model No.: HD50G / UFF Filter

a. Assembly to consist of, from left to right, three fryers and one dump station with rod style food warmer, all on a common frame assembly.
b. Provide common manifold to single point 1" gas connection with gas pressure regulator. Provide 48" long Dormont Posi-Set kit to include gas quick disconnect assembly with restraining device, free spin fittings, swivel links, both ends and caster track locks. KEC to coordinate floor mounting of tracks with fire suppression contractor for accurate positioning.
c. Heavy-duty casters, fixed on rear, swivel with brakes on front.

ITEM 475 UNDERCOUNTER REFRIGERATOR
Quantity: One
Manufacturer: True Food Service
Model No.: TUC-48

a. Provide with low profile casters for installation below Back counter.

ITEM 476 SPARE NUMBER

ITEM 477 SPARE NUMBER

ITEM 478 UNDERCOUNTER FREEZER
Quantity: One
Manufacturer: True Food Service
Model No.: TUC-48F

a. Provide with low profile casters for installation below Back counter.

ITEM 479 REACH-IN REFRIGERATOR
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 480 SPARE NUMBER

ITEM 481 BACK COUNTER with HAND SINK
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34" high work surface with square turn-down edge, 4" x 1" backsplash, intermediate shelf and sliding doors full width of counter.
b. Heavy duty faucet with 10" spout and one rotary waste assembly.

ITEM 482 PRETZEL WARMER
Quantity: Two – By Vendor, Not in Foodservice Contract

ITEM 483 POPCORN POPPER
Quantity: One
Manufacturer: Gold Medal
Model No.: 2003
a. Heavy duty cord and plug

ITEM 484 PIZZA DISPLAY/WARMER
Quantity: One
Manufacturer: Hatco
Model No.: FDWD-1
a. 4" adjustable legs

ITEM 485 CHEESE WARMER
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 486 CHILI WARMER
Quantity: One – By Vendor, Not in Foodservice Contract

ITEM 487 HOT DOG ROLLER GRILL
Quantity: One
Manufacturer: APW Wyott
Model No.: HRS-50
a. 208V model with Tru-Turn rollers and 4" legs.
b. Stainless steel finish.

ITEM 488 HEATED DRAWERS
Quantity: One
Manufacturer: APW Wyott
Model No.: BC-50

ITEM 489 BACK COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel
a. 34" high work surface with square turn-down edge, 4" x 1" backsplash, intermediate shelf and sliding doors full width of counter.

ITEM 490 SPARE NUMBER

ITEM 491 FRONT COUNTER
Quantity: One
Manufacturer: Custom Fabricated
Model No.: Stainless Steel

a. 34” high work surface with square turn-down edges on both sides, 4” x 1” backsplash at walls, open pipe leg base construction full width of counter.
b. Coordinate with low wall construction, security enclosures and built-in equipment.

ITEM 492 SPARE NUMBER

ITEM 493 SPARE NUMBER

ITEM 194 SODA DISPENSER with ICE BIN
Quantity: Lot – By Vendor, Not in Foodservice Contract

ITEM 495 CUP DISPENSER MODULE
Quantity: Five
Manufacturer: Dispense-Rite.
Model No.: WR-CC-22
Mount to face of vendor supplied soda dispensers.

ITEM 496 HEATED DRAWERS
Quantity: Eight
Manufacturer: APW Wyott
Model No.: HDD-2

a. Provide 3-1/2” casters, (2) with brakes and heavy duty cord and plug.

ITEM 497 POS EQUIPMENT
Quantity: Lot – By Owner /Operator, Not in Foodservice Contract

ITEM 498 SPARE NUMBER

ITEM 499 SPARE NUMBER

ITEM 500 SPARE NUMBER

END OF SECTION 114000

SECTION 118226 - FACILITY WASTE COMPACTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes waste compactors and diverters.

1.3 DEFINITIONS

A. General: See the "WASTEC 2007 Listing of Rated Stationary Compactors" for detailed definitions of waste-compactor terminology.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties and accessories, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Dimensions locating chutes that interface with waste compactors.
3. Location and installation details of automatic sprinkler in hopper of each chute-fed compactor.
4. Equipment access points and required space for equipment service and operation.
5. Setting drawings, templates, and instructions for installing anchor bolts and other anchorages.
6. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of waste compactor, from manufacturer.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For waste compactors to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hour(s') normal travel time from Installer's place of business to Project site.

B. Waste-Compactor Standards: ANSI Z245.21 including annexes and NFPA 82.

C. Waste-Container Standards: ANSI Z245.30 and ANSI Z245.60.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of waste-compactor Installer. Include monthly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper waste-compactor operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 - PRODUCTS

2.1 WASTE COMPACTORS

A. Waste Compactor: Manufacturer's standard stationary-horizontal-type stationary compactor, complying with requirements, liquidtight, and with components, options, and accessories needed to provide a complete, functional system.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Model RP-200 SB by Rudco Products, Inc. or comparable product by one of the following:

a. Galbreath, Inc.; a Wastequip company.
b. Marathon Equipment Company; a Dover company.
c. SP Industries, Inc.
d. Wastequip, Inc.

2. Manufacturer-Rated Size (Volume): Minimum 2.00 cu. yd..
3. Clear Top Opening (Length by Width): Minimum 60 by 34-1/2 inches.
4. Cycle Time: Maximum 70 seconds.
5. Normal/Maximum Resultant Ram Forces: 50,240/57,776 lbf.
6. Normal/Maximum System Pressures: 2000/2300 psi.
7. Approximate Weight: 3800 lb.
8. Motor Size: Remote 10 hp.
9. Electrical Power Supply: Manufacturer's standard.

10. Controls: Manufacturer's standard.
11. Finish: Manufacturer's standard.
12. Deodorizing Device: Provide Model 105A Sonozaire® Odor Neutralizer or approved substitute.

B. Container: One 42 yard, octagon container.

1. Approximate Weight: 7210 lbs.

2.2 FABRICATION

A. Fabricate waste compactors with smooth, eased, exposed edges to prevent injury to persons in vicinity of the equipment.

B. Fabricate containers, hoppers, compaction chambers, unit bodies, and similar components of steel with welded joints. Reinforce with steel members sized and spaced to withstand impacts and pressures of normal operations and to prevent deformation.

C. Fabricate equipment with replaceable parts at points of normal wear.

D. Fabricate liquidtight compactor baffles to stop liquid from leaking out.

E. Fabricate diverter to fit chute and properly align with compactor hoppers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, clearances, service rough-ins, and other conditions affecting performance of waste-compactor work.

B. Examine walls, floors, and chutes for suitable conditions where each waste compactor will be installed.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install each waste compactor according to manufacturer's written instructions, ANSI Z245.2, and ANSI Z245.21 including annexes.

B. Install automatic sprinkler in hopper of each chute-fed compactor according to NFPA 82.

C. Set waste compactors level, plumb, properly aligned, and securely in place. Anchor as required for secure operation.

D. Install diverter to chute and properly align with compactor hoppers.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to ANSI Z245.21, Annex D, "Tests for Evaluation of Equipment and Performance," and manufacturer's written instructions.
2. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
3. Verify unrestricted access to each firefighting access door or fire port required by ANSI Z245.21 and NFPA 82 for compactor container(s).
4. Verify correct locations, color-coding, and legibility of caution, warning, and danger markings.
5. Certify compliance with test parameters.

C. A waste compactor will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain waste compactors according to manufacturer's requirements and ANSI Z245.2.

END OF SECTION 118226

COMPACTORS

Stationary Compactor RP-200 thru RP-400

RP-300 SHOWN

Ideal For:

- Industrial Complexes
- Office Buildings
- Supermarkets
- Malls/Strip Malls

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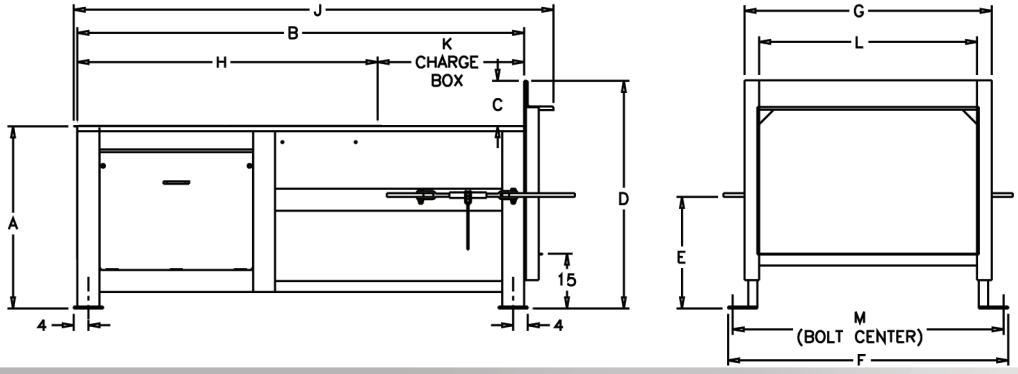
COMPACTORS

Stationary Compactor



Stationary Compactor Specifications

	RP-200 SB	RP-200	RP-300	RP-400
MFG. RATING	2.0 CUBIC YARDS	2.0 CUBIC YARDS	3.0 CUBIC YARDS	3.44 CUBIC YARDS
NSWMA RATING	1.52 CUBIC YARDS	1.56 CUBIC YARDS	2.05 CUBIC YARDS	2.97 CUBIC YARDS
CYCLE TIME	SEC.	63 SEC.	57 SEC.	54 SEC.
NORMAL RAM FORCE	50,240	48,000	48,042	52,200
MAXIMUM RAM FORCE	57,776	56,500	56,520	61,400
NORMAL OPERATING PRESSURE	2000	1700	1700	1700
MAXIMUM OPERATING PRESSURE	2300	2000	2000	2000
CYLINDER (BORE x STROKE X ROD)	4" X 31" X 2 1/2"	6" x 56" x 3"	6" x 66" x 3"	6" X 80" X 4-1/2"
MOTOR	Remote 10HP	10 HP	10 HP	Remote 15 HP
PUMP SIZE	10.5 GPM	10.5 GPM	10.5 GPM	15 GPM
PACKER FLOOR	1/2" PLATE	1/2" PLATE	1/2" PLATE	1/2" PLATE
PACKER SIDES	1/4" PLATE W/ 6" CHANNEL	1/4" PLATE w/ 6" CHANNEL	1/4" PLATE w/ 6" CHANNEL	1/4" PLATE w/4"x 3" ANGLE
RAM TOP	1/4" PLATE	1/4" PLATE	1/4" PLATE	1/4" PLATE
RAM FACE	3/8" PLATE W/ 4" X 3" ANGLE	3/8" PLATE w/ 4" x 3" ANGLE	3/8" PLATE w/ 4" x 3" ANGLE	1/2" PLATE w/ 4" x 3" ANGLE
CHARGE BOX OPENING	34 1/2" x 60"	40" x 60"	50" x 60"	60" x 69"
DIMENSION - A	49 7/8"	49-7/8"	49-7/8"	54-1/2"
DIMENSION - B	65	123-1/2"	141-1/2"	182"
DIMENSION - C	12 1/2"	12-1/2"	12-1/2"	8"
DIMENSION - D	62 3/8"	62-3/8"	62-3/8"	62-3/8"
DIMENSION - E	30 1/2"	30-1/2"	30-1/2"	31"
DIMENSION - F	76 1/2"	76-1/2"	76-1/2"	76-1/2"
DIMENSION - G	68"	68"	68"	68"
DIMENSION - H	30 1/2"	80-1/4"	88-1/4"	112"
DIMENSION - J	72 1/2"	131"	149"	189"
DIMENSION - K	34 1/2"	41"	51"	69-1/2"
DIMENSION - L	60"	60"	60"	60"
DIMENSION - M	67 1/2"	67-1/2"	67-1/2"	67-1/2"
APPROXIMATE WEIGHT	3,800	5,830	6,130	8,400
NOTES	No Side Access Door/External PU	Integral PU	Integral PU	External PU

06/09 #124

RUDCO PRODUCTS, INC

CORPORATE OFFICE: 114 E. Oak Rd. • Vineland, NJ 08360 • Ph:1.856.691.0800 • Fax: 1.856.696.0084
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Toll Free: 1.800.828.2234 • E-Mail: sales@rudco.com

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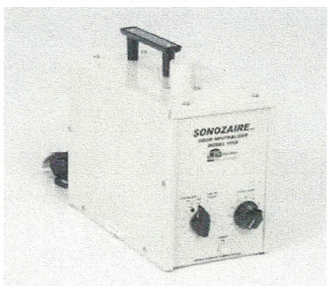
Models

Sonozaire® Odor Neutralizer

Sonozaire Odor Neutralizers produce ozone electronically from oxygen in the air. Ozone is an activated form of oxygen that oxidizes odor molecules and reduces them to odorless compounds. They are used in numerous applications to control and destroy organic odors. All Sonozaire models have an adjustable ozone output level to allow maximum output for short treatments, lower levels for longer treatments or continuous use. These models are designed for use in uninhabited locations, unless used with control methods to limit the ozone level to OSHA or EPA limits. Please contact us for applications and selections in other cases to meet your requirements. Use the chart below to select the Sonozaire Model that fits your needs. For distributor locations or more technical information, please contact us by phone, fax or e-mail.

Sonozaire Models

105A



115A

330A

630A

Optional equipment to enhance the Sonozaire, such as 220V conversions, weatherproofing, flexible hose, flanges, "Y" outlets, elbows, clamps, wall hanger kits, timers, ozone sensors and others are available.

Applications	Measure	105A	115A	330A	630A
Compactor/Container	(cu yards)	0 to 4	4 to 8	8 to 30	30 to 50
approx volume	(cu meters)	0 to 3	0 to 6	6 to 23	23 to 38
Restoration Chamber	(cu feet)	800	1,700	7,500	15,000
approx volume	(cu meters)	23	48	210	420
On Site Restoration	(cu feet)	1,000 to 5,000	2,500 to 15,000	6,000 to 150,000	15,000 to 750,000
approx volume	(cu meters)	28 to 142	70 to 425	170 to 4,250	425 to 21,240
Cabinet					
Approx Dimensions	(LxHxD)	13x11x7	22x20x7.5	24x27x14	36x27x14
	(LxHxDcm)	33x28x17	56x51x19	61x69x36	91x69x36
Weight	(lbs)	9	32	58	85
	(kg)	4	14.5	26.3	38.6
Equipment Specifications					
Electrical Power	(watts)	40	70	125	260
Blower Air Volume@ 0" SP					
at 60hz	(cfm)	16	60	60	100
at 50hz	(cu m hr)	13	86	86	141

Equipment is designed for 115 volt, 50/60 hz, 1 ph (Optional 220-240 volt, 50/60 hz, 1 ph) AC. Sonozaire Odor Neutralizers are industrial ozone generators designed to be utilized in uninhabited areas or in volumes limited by OSHA regulations.

Other Typical Applications

Auto Detailing	Hotel/Motel	Residential (Home Use)
105A or 115A	**105A**	**105A**

CB&I Howe-Baker Sonozaire Division 3102 E Fifth St, Tyler, TX 75701
◆(800) 323-2115 ◆fax (903) 581-6178
◆Email: sonozaire@cbi.com ◆Website: www.sonozaire.com

SECTION 123640 - STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes stone countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For each variety of stone, stone accessory, and manufactured product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

1. Show locations and details of joints.
2. Show direction of veining, grain, or other directional pattern.

C. Samples for Verification:

1. For each stone type indicated, in sets of Samples not less than 12 inches square. Include three or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Material Test Reports:

1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, according to referenced ASTM standards. Base reports on testing done within previous five years.
2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For stone countertops to include in maintenance manuals. Include product data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate stone countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of stone countertops.

C. Mockup: Build mockup to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Sealant Adhesion and Compatibility Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.

1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
2. Store stone on wood A-frames or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone,from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

1. For stone types that include same list of varieties and sources, provide same variety from same source for each.

2.2 GRANITE (STONE1)

A. Material Standard: Comply with ASTM C 615.

B. Description: Uniform, fine-grained, light-brown stone without veining.

C. Varieties and Sources: Subject to compliance with requirements, provide the following:

1. Daltile; Santa Cecilia G287.

D. Cut stone from contiguous, matched slabs in which natural markings occur.

E. Finish: Polished.

2.3 GRANITE (STONE2)

A. Material Standard: Comply with ASTM C 615.

B. Description: Uniform, medium-grained, brown-gold stone.

C. Varieties and Sources: Subject to compliance with requirements, provide the following:

1. Giallo Ornamental; from Marble.com

D. Cut stone from contiguous, matched slabs in which natural markings occur.

E. Finish: Polished.

F. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.4 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

A. General: Use only adhesives formulated for stone and ceramic tile and that are recommended by their manufacturer for the application indicated.

B. Stone Adhesive: Two-part epoxy adhesive, formulated specifically for bonding stone to stone, with an initial set time of not more than two hours at 70 deg F.

1. Color: Match stone.

C. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 079200 "Joint Sealants" and will not stain the stone it is applied to.

1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone.
2. Color: Clear.
3. Sealants shall have a VOC content of 250 g/L or less.

D. Stone Cleaner: Specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

E. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

2.5 STONE FABRICATION, GENERAL

A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.

1. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by Architect.

B. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.

C. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
2. Clean sawed backs of stones to remove rust stains and iron particles.
3. Dress joints straight and at right angle to face unless otherwise indicated.
4. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
5. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
6. Fabricate molded edges with machines having abrasive shaping wheels made to reverse contour of edge profile to produce uniform shape throughout entire length of edge and with precisely formed arris slightly eased to prevent snipping, and matched at joints between units. Form corners of molded edges as indicated with outside corners slightly eased unless otherwise indicated.
7. Finish exposed faces of stone to comply with requirements indicated for finish of each stone type required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.

D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

2.6 STONE COUNTERTOPS

A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual VI."

B. Nominal Thickness: Provide thickness indicated, but not less than 1-1/4 inches. Gage backs to provide units of identical thickness.

C. Edge Detail: 1-1/2 inch full bull nose.

D. Splashes: Provide 3/4-inch- thick backsplashes and end splashes unless otherwise indicated.

1. Height: 4 inches.
2. Top-Edge Detail: Straight, slightly eased at corner.

E. Joints: Fabricate countertops without joints.

F. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated and as follows:

1. Bonded Joints: 1/32 inch or less in width.

G. Cutouts and Holes:

1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive stone countertops and conditions under which stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone countertops.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone countertops.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by stone countertop Installer for anchoring stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.

B. Before installing stone countertops, clean dirty or stained stone surfaces by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives. Allow stone to dry before installing.

3.3 CONSTRUCTION TOLERANCES

A. Variation from Level: Do not exceed 1/8 inch in 96 inches, 1/4 inch maximum.

B. Variation in Joint Width: Do not vary joint thickness more than one-fourth of nominal joint width.

C. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch difference between planes of adjacent units.

D. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch difference between edges of adjacent units, where edge line continues across joint.

3.4 INSTALLATION OF COUNTERTOPS

A. General: Install countertops by adhering to supports with water-cleanable epoxy adhesive.

B. Do not cut stone in field unless otherwise indicated. If stone countertops or splashes require additional fabrication not specified to be performed at Project site, return to fabrication shop for adjustment.

C. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight, true, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

D. Set stone to comply with requirements indicated. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

E. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

G. Install backsplashes and end splashes by adhering to wall with water-cleanable epoxy adhesive and to countertops with stone adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

H. Install backsplashes and end splashes by adhering to wall with water-cleanable epoxy adhesive. Leave 1/16-inch gap between countertop and splashes for filling with sealant. Use temporary shims to ensure uniform spacing.

I. Grout joints to comply with ANSI A108.10. Remove temporary shims before grouting. Tool grout uniformly and smoothly with plastic tool.

J. Apply sealant to gaps specified for filling with sealant; comply with Section 079200 "Joint Sealants." Remove temporary shims before applying sealant.

3.5 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.

B. Remove and replace stone countertops of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective countertops.
3. Defective joints, including misaligned joints.
4. Interior stone countertops and joints not matching approved Samples and mockups.
5. Interior stone countertops not complying with other requirements indicated.

C. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.

D. Clean stone countertops no fewer than six days after completion of installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.

E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

END OF SECTION 123640

STONE1

Daltile Santa Cecilia

STONE2

Giallo Ornamental

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient-tile entrance mats.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mat.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient-Tile Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 RESILIENT-TILE ENTRANCE MATS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Lees; Step in Style Modular.

B. Carpet-Type Tiles (MAT1): Nylon carpet bonded to 1/8- to 1/4-inch- thick, flexible vinyl backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.

1. Colors, Textures, and Patterns: 524 Woodland Brown.
2. Tile Size: 24 inches square.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes,and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.3 PROTECTION

A. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124813

MODULAR SPECIFICATIONS

Style Number	GT066
Style Name	Step In Style Modular
Collection	Tuff Stuff
Construction	tufted
Surface Texture	textured patterned cut and loop
Gauge	1/12 (47.00 rows per 10 cm)
Density	8,930
Weight Density	321,488
Stitches Per Inch	10.0 per inch (39.37/10 cm)
Finished Pile Thickness	.129" avg (3.3 mm)
Dye Method	yarn dyed
Backing Material	EcoFlex ICT
Fiber Type	Fortis™ Nylon
Fiber Technology	Sentry Soil Protection
Face Weight	32.0 oz/yd2 (1085.12 g/m2)
Size/Width	24" x 24" (60.9 cm x 60.9 cm)
Installation Method	brick ashlar, quarter turn
IAQ Green Label Plus	1098
CRI Rating	Severe Traffic
Pattern Repeat	Not Applicable
Warranties	Lifetime Limited Modular Warranty, Lifetime Static

518
BLARNEY STONE

524
WOODLAND BROWN

547
BLUE WAVE

548
CARBON BLACK

SECTION 124816 - ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes recessed floor grilles and frames.

1.3 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor grilles and frames.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for entrance floor grilles and foot grilles.

B. Shop Drawings:

1. Items penetrating floor grilles and frames, including door control devices.
2. Divisions between grille sections.
3. Perimeter floor moldings.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor grilles and frames to include in maintenance manuals.

1.6 FIELD CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Mats Inc.; Design Track.

2.2 ENTRANCE FLOOR GRILLES, GENERAL

A. Structural Performance: Provide floor grilles and frames capable of withstanding the following loads and stresses:

1. Uniform floor load of 300 lbf/sq. ft..
2. Wheel load of 350 lb per wheel.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities.

2.3 FLOOR GRILLES

A. General: Provide manufacturer's standard floor-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.

B. Aluminum Floor Grilles: Provide manufacturer's standard floor grilles with extruded members, top-surfaced tread rails, and as follows:

1. Tread Rails: Extruded-aluminum tread rails.

a. Aluminum Color: Mill finish.

2. Blades: T-Shaped blades, 3/8” x 1/8” x 1” Size, spacing between blades not to exceed 3/16 inch.
3. Top Surface: Smooth aluminum.
4. Grille Size: As indicated.

2.4 FRAMES

A. Provide manufacturer's standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

B. Recessed Frame Integral with Concrete Substrate: The perimeter frames shall be an inverted "T" shape such as model "VV" by Mats Inc, in order to anchor the structure into the concrete. All aluminum frames shall be pre-assembled at factory incorporating welded construction for all joints. Each grille section shall incorporate an invisible section divider integrated and welded within the frame. Frames and grilles shall be shipped fully assembled in protective wooden crating to each jobsite. For sections larger than 6'-0 by 8'-0 a mechanical joint is to be provided, (if specified).

2.5 SUPPORT SYSTEM

A. Level Bed Applications: Provide manufacturer's standard, vinyl cushion support system.

2.6 MATERIALS

A. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52 as standard with manufacturer. Coat surface of frame in contact with cementitious materials with manufacturer's standard protective coating.

2.7 FABRICATION

A. Shop fabricate floor grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.

B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.8 ALUMINUM FINISHES

A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of floor grilles and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed floor grilles and frames to comply with manufacturer's written instructions at locations indicated and with top of floor grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set floor-grille tops at height for most effective cleaning action. Coordinate top of floor-grille surfaces with doors that swing across grilles to provide clearance under door.

3.3 PROTECTION

A. After completing frame installations, provide temporary filler of plywood or fiberboard in floor-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 124816

Mats Inc. Technical Data
for Design Track

Product Description

General	Extruded aluminum alloy 6061-T6, containing 64% pre-consumer and 16% post-consumer recycled content, manufactured in sections to increase ease of maintenance
Surface Aspect	Cross-cut rectangular surface with cross bolted supports
Thickness	1"
Maximum Panel Size	48" (front to back) x 42" (left to right)

Technical Specifications

	Design Track		
Frame Options			
TT overlap frame (New construction, retrofits, wood floors)	"Z" shaped, supplied with a sound gasket. For sections larger than 6' x 8', a mechanical joint is to be provided. A silicon joint is to be applied between the frame and the finished floor to prevent any water infiltration for pan applications only. If specified, a pan will be supplied. See below for pan options.		
VV embedded frame (New construction)	Inverted "T" shape in order to anchor the structure into the concrete. Supplied with a sound gasket. For sections larger than 6' x 8', a mechanical joint is to be provided. A silicon joint is to be applied between the frame and the finished floor to prevent any water infiltration for pan applications only. If specified, a pan will be supplied. See below for pan options.		
AD angle frame (retrofits, new construction, wood floors)	"L" shaped for new or existing openings. Supplied with a sound gasket. For sections larger than 6' x 8, a mechanical joint is to be provided. A silicon joint is to be applied between the frame and the finished floor to prevent any water infiltration for pan applications only. If specified, a pan will be supplied.		
Pan options	If specified, the frames will be supplied with a pan. Select the following options: 20 gauge galvanized steel, 20 gauge stainless steel or aluminum.		
Product Properties			
Live load deflection	Minimum uniform load of 3110 Newtons over a 4" square (100 mm). Obtained a 1/180" deflection over a 2 foot square span.		
Lateral change deformation	Not to exceed 9 (visual) after application of maximal charge of 6130 Newtons (1,380 lbs.) at a 45 degree angle in relation to the surface.		
Performance			
Product corrosion	Able to sustain 1,000 hours of salt fog without any notable changes (ASTM B117)		
LEED			
IEQ Credit 5	LEED-NC v. 3	For 1 point: permanently installed entrance system at least ten feet in length	Design Track is designed for permanent installation.
MR Credit 2	LEED-NC v.3	For 1 – 2 points: value (weight or volume) of recycled or salvaged material = min. of 50% of all construction waste	Design Track is manufactured from material that can be diverted from disposal and reused.
MR Credit 4	LEED-NC v. 3	For 1 - 2 points: $ value of all materials = min. average 10% recycled content	64% pre-consumer and 16% post-consumer recycled

MR Credit 5	LEED-NC v. 3	For 1 - 2 points: The material must be manufactured within 500 miles of the project location.

Foot Grilles

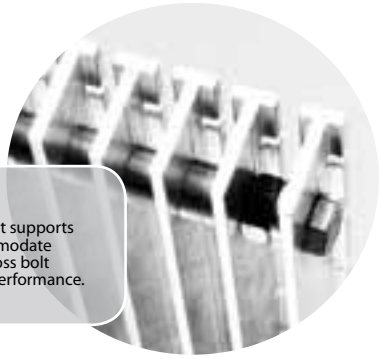
ZONES 1 2 3 4

Design Track

Design Track
Deep Recessed System

Pro Track Series

Pro Track Series



Pro Track Technology
Pro Track Series Foot Grilles feature cross bolt supports with individual aluminum spacers to accommodate the heaviest rolling loads in the industry. Cross bolt technology provides durable, long-lasting performance.

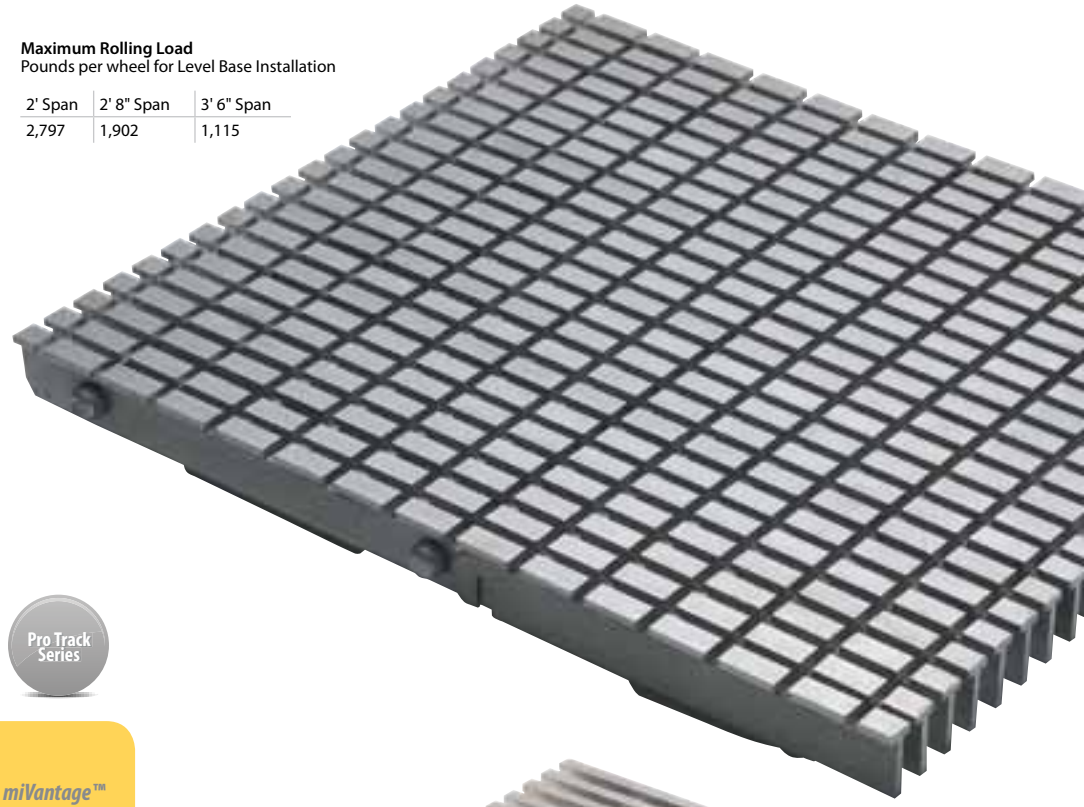
Features | **Zones** 1 2 3 4

- Upscale appearance adds prestige to any environment
- Exclusive, cross bolt technology outlasts traditional welded key-lock construction
- Outstanding scraping performance for entrances with multi-directional traffic
- Anti-slip surface for exterior and interior applications; ADA compliant
- Maintenance-free surface looks brand new for years
- Frames come pre-assembled
- Custom shapes available (not recommended for radius cuts)
- Drain pan optional
- Common Uses–office buildings, retail stores, malls, hospitals, nursing homes, schools, airports

miVantage™ Best for heaviest traffic and rolling loads

Maximum Rolling Load
Pounds per wheel for Level Base Installation

2' Span	2' 8" Span	3' 6" Span
2,797	1,902	1,115



Specifications

Material
Heavy gauge 6061-T6 aluminum with 64% pre-consumer and 16% post-consumer recycled content, mill finish

Style
Cross-cut rectangular surface with bolted cross supports

Size
Custom made to your requirements. Consult our Product Specialists for assistance.

Maximum Panel Size
48" (front to back) x 42" (left to right)
Multiple panels are used to construct the foot grille system

Possible LEED Credits

- MR Credit 2 (1 point)
- MR Credit 4 (1-2 points)
- MR Credit 5 (1-2 points)
- IEQ Credit 5 (1 point)

Ultra Track
Deep Recessed System

Pro Track Series

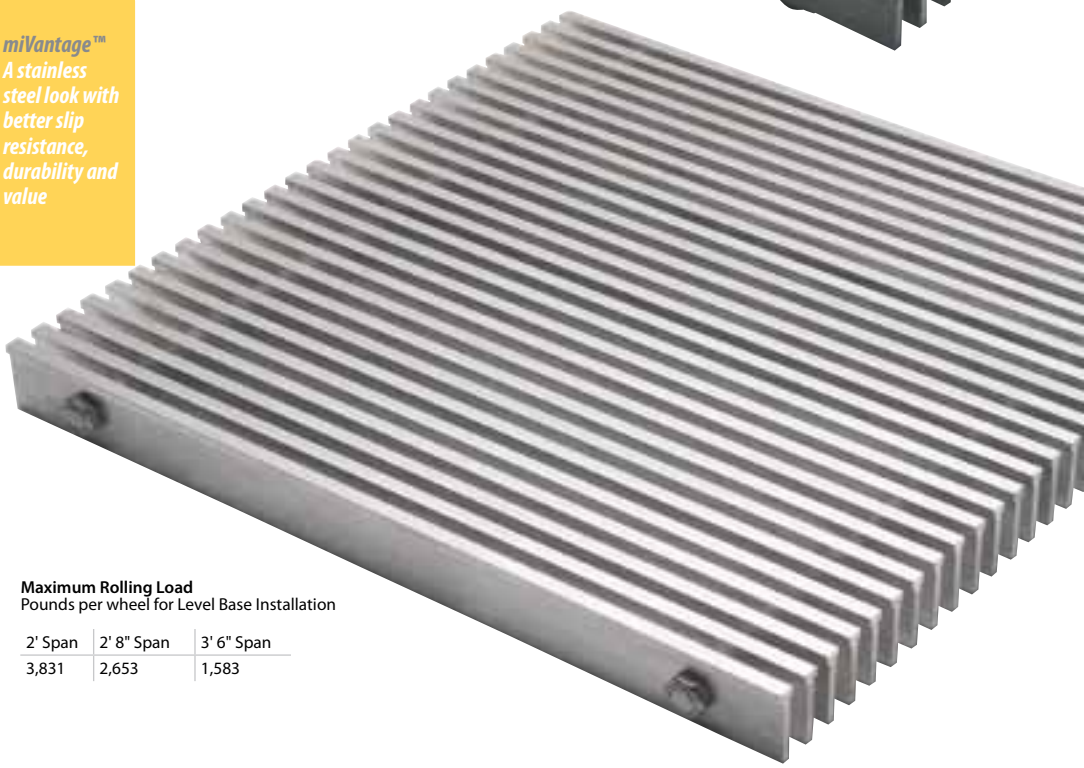
Features | **Zones** 1 2 3 4

- Exclusive, cross bolt technology outlasts traditional welded key-lock construction
- Anti-slip surface for indoor applications; ADA compliant
- Maintenance-free surface looks brand new for years
- Unique "T" blade design prevents debris from lodging within the grille
- Custom shapes available
- Frames come pre-assembled
- Best choice for radius cuts and revolving doors
- Drain pan option available
- Common Uses–office buildings, retail stores, malls, convenience stores, schools

miVantage™ A stainless steel look with better slip resistance, durability and value

Maximum Rolling Load
Pounds per wheel for Level Base Installation

2' Span	2' 8" Span	3' 6" Span
3,831	2,653	1,583



Specifications

Material
Heavy gauge 6061-T6 aluminum with 64% pre-consumer and 16% post-consumer recycled content, mill finish

Style
Linear rails with bolted cross supports

Size
Custom made to your requirements. Consult our Product Specialists for assistance.

Maximum Panel Size
48" (front to back) x 42" (left to right)
Multiple panels are used to construct the foot grille system

Possible LEED Credits

- MR Credit 2 (1 point)
- MR Credit 4 (1-2 points)
- MR Credit 5 (1-2 points)
- IEQ Credit 5 (1 point)

Safe Track

Deep Recessed System

Pro Track Series

Features | **Zones** 1 2 3 4

Anti-slip surface for indoor and outdoor applications; ADA compliant

Exclusive, cross bolt technology outlasts traditional welded key-lock construction

Maintenance-free surface looks brand new for years

Custom shapes available (not recommended for radius cuts)

Frames come pre-assembled

Drain pan option available

Common Uses–office buildings, retail stores, malls, hospitals, schools, ski areas, sporting facilities

miVantage™ Great for heavy traffic and rolling loads

Maximum Rolling Load
Pounds per wheel for Level Base Installation

2' Span	2' 8" Span	3' 6" Span
2,032	1,394	827

Specifications

Material
Heavy gauge 6061-T6 aluminum with 64% pre-consumer and 16% post-consumer recycled content, mill finish

Style
Cross-cut surface with bolted cross supports

Size
Custom made to your requirements. Consult our Product Specialists for assistance.

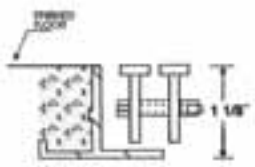
Maximum Panel Size
48" (front to back) x 42" (left to right)
Multiple panels are used to construct the foot grille system

Possible LEED Credits

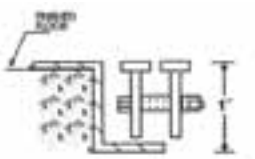
MR Credit 2 (1 point)
MR Credit 4 (1-2 points)
MR Credit 5 (1-2 points)
IEQ Credit 5 (1 point)

Depth	VV or AD Frame (New Construction)	TT Overlap Frame (Retrofits)
Grille Only	1"	1"
Grille & Frame (Level Base)	1-1/8"	1"
Grille & Frame (Drain Pan)	2-1/8"	2"

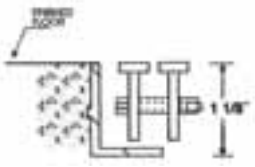
Level Base Installation Options
For Design Track, Ultra Track and Safe Track



VV EMBEDDED FRAME



TT OVERLAP FRAME



AD FRAME

Advanced Track
Deep Recessed System

Pro Track Series

Dual Track
Deep Recessed System

Pro Track Series

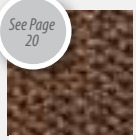
Commuter rail application takes on the traffic of the entire city of Chicago

Designer Insert Options

Enhance the beauty of the entrance system by matching Zone 3 (lobby) matting with the Foot Grille Designer Inserts in Zone 2 (vestibule). Coordinating Zone 3 matting product pages are referenced below.

Supreme Nop
Aggressive and attractive polypropylene fiber

See Page 20


Tweed Brown


Sable Brown


Natural


Autumn Red

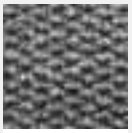

Spruce


Sapphire


Black Walnut


Midnight Blue


Charcoal


Dark Gray

New York Collection
Premium high durability nylon fibers (6.6)

See Page 19


Blue


Red


Charcoal


Dark Gray


Cocoa

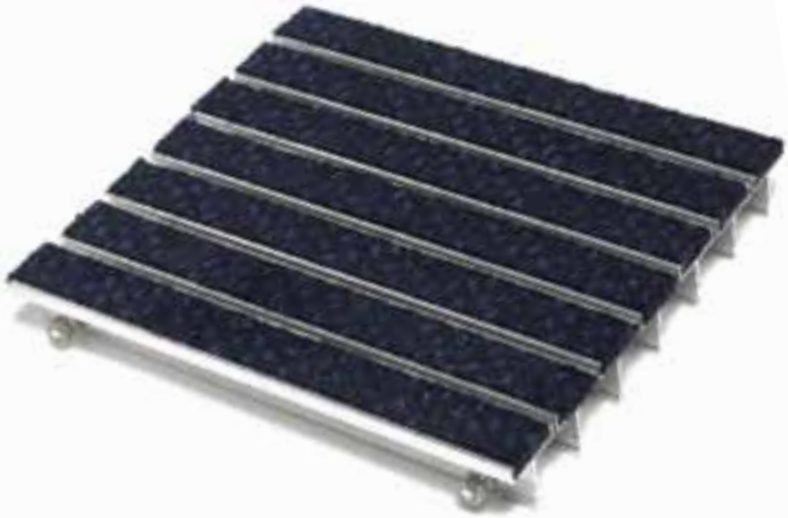

Brown


Charcoal Splash

Dri Track

Deep Recessed System

Pro Track Series



miVantage™ Heaviest rolling load in the industry with a wide selection of Designer Insert Options

Features

Zones 1 2 3 4

- Exclusive, cross bolt technology outlasts traditional welded key-lock construction
- Heaviest rolling load in the industry
- Anti-slip surface for indoor applications; ADA compliant
- Wide variety of Designer Insert Options available
- Custom shapes available
- Advanced Track and Dri Track can be radius cut
- Frames come pre-assembled
- Drain pan option available
- Common Uses–office buildings, retail stores, malls, supermarkets, hospitals, schools, libraries, airports

Specifications

Advanced Track Material
Heavy gauge 6061-T6 aluminum with aluminum alloy 6063-T5 scraping rails and standard 100% nylon fiber drying inserts. 58.62% pre-consumer and 15.5% post-consumer recycled content. Recycled content varies with Designer Insert Options.

Dual Track Material
Heavy gauge 6061-T6 with 43.97% pre-consumer and 14.12% post-consumer recycled content, aluminum with vinyl scraping and standard 100% nylon drying inserts. Vinyl scraper bars available in black, gray and brown. Recycled content varies with Designer Insert Options.

Dri Track Material
Heavy gauge 6061-T6 aluminum with standard 100% nylon fiber drying inserts. 51.84% pre-consumer and 14.86% post-consumer recycled content. Recycled content varies with Designer Insert Options.

Style
Scraping and drying surface with bolted cross supports

Size
Custom made to your requirements. Consult our Product Specialists for assistance.

Maximum Panel Size
48" (front and back) x 42" (left to right)
Multiple panels are used to construct the foot grille system

Possible LEED Credits

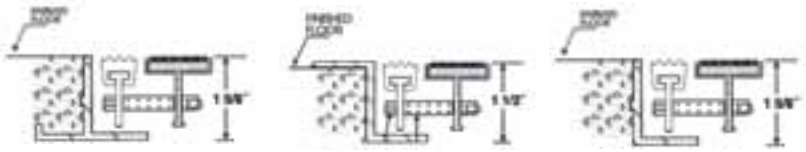
- MR Credit 2 (1 point)
- MR Credit 4 (1-2 points)
- MR Credit 5 (1-2 points)
- IEQ Credit 5 (1 point)

Depth	VV or AD Frame (New Construction)	TT Overlap Frame (Retrofits)
Grille Only	1-1/2"	1-1/2"
Grille & Frame (Level Base)	1-5/8"	1-1/2"
Grille & Frame (Drain Pan)	2-1/2"	2-1/2"

Maximum Rolling Load
Pounds per wheel for Level Base Installation

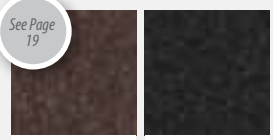
2' Span	2'8" Span	3'6" Span
3,831	2,653	1,583

Level Base Installation Options
For Advanced Track, Dual Track and Dri Track



VV EMBEDDED FRAME | TT OVERLAP FRAME | AD FRAME

Boston-Fenway
High durability nylon fibers (6.6)
See Page 19


Brown

Charcoal


Gray


Blue

Boston-Kenmore
High durability nylon fibers (6.6)
See Page 19


Brown


Charcoal


Gray


Blue

NaturTile™
Designer nylon fibers (6.6)
See Page 13


Slate


Ocean


Earth


Meadow

Nuway®
Surface/Recessed System

Features | **Zones** 1 2 3 4

Dual strip design scrapes off debris and absorbs moisture
Reversible design doubles life span
Withstands heavy foot traffic and wheeled loads
Numerous design and color options
Anti-slip surface; ADA compliant
Specific configurations available for Zone 1
Common Uses–office buildings, retail stores, malls, supermarkets, hospitals, schools, banks

miVantage™ Ultra durable design and reversible for extended life

Specifications

Material
Alternating strips of aluminum scraper bars and wiper strips (buffed or unbuffed rubber) with 4.19-8.73% pre-consumer and 12.56-26.19% post-consumer recycled content

Size
Custom made to your requirements. Consult our Product Specialists for assistance.

Thickness
7/16" or 11/16"

Critical Radiant Flux
(ASTM E648) Class 1

Coefficient of Friction
(D2047) 0.79

Styles

Standard
12 mm, closed construction, Charcoal wiper strip, aluminum scraper bar

Plainguard
Unbuffed rubber wiper strip with aluminum (Zones 1 & 2)

Design
Choice of colored buffed rubber wiper strip with aluminum scraper bar (Zone 2)

Recycled Content

Standard
8.73% pre-consumer and 26.19% post-consumer

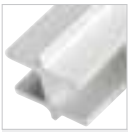
All Styles with Aluminum Scraper Bar
4.19% - 8.73% pre-consumer and 12.56% - 26.19% post-consumer

Possible LEED Credits

MR Credit 4 (1-2 points)
IEQ Credit 5 (1 point)

Depth	Ramp Frame	Schlüter™ Frame	Deep Frame
Grille Only	7/16"	7/16"	7/16" or 11/16"
Grille & Frame	7/16"	7/16" to 1-9/16" *	1-1/4"

** Varies based on model selected*


Aluminum Scraper Bar

Wiper Strips


Unbuffed


Gray


Charcoal


Ocean


Petrol


Evergreen


Willow


Scarlet

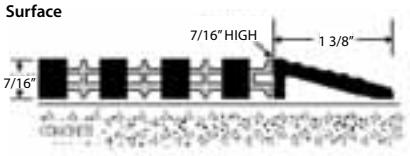

Claret


Violet

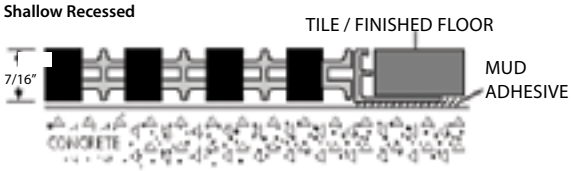

Sienna

Installation Options

Surface



Shallow Recessed



Nuway® HD

Heavy duty, closed construction foot grille for heavy traffic with high point loads. Scraper bars are constructed of an extremely thick gauge aluminum extrusion and combined with dual wiper strips to produce a system ideal for hospitals, train stations, airports and more.

Contact our Product Specialists for more information.

Grate Grid
Recessed System

Features | **Zones** 1 2 3 4

Durable "I"-beam construction secured with key-lock bars
Insert options include carpet, vinyl, brush, vinyl abrasive, and serrated aluminum; visit our website or consult our Product Specialists for assistance
Common Uses–entryways, vestibules and foyers

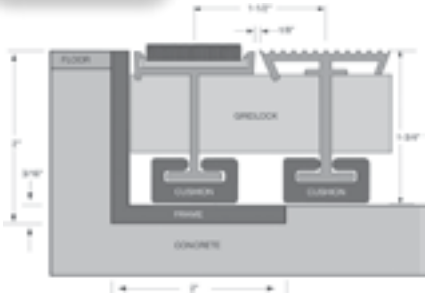
Specifications

Material
6063-T52 aluminum with 46% pre-consumer recycled content and various insert options
Size
Consult our Product Specialists for assistance

Possible LEED Credits

MR Credit 4 (1-2 points)
MR Credit 5 (1-2 points)
IEQ Credit 5 (1 point)

Brush Insert Option



Depth

Grille Only	Grille & Frame
1-3/4"	2"

Grate Mat
Surface/Recessed System

Features | **Zones** 1 2 3 4

Grate Mat "rolls up" for easy handling and maintenance
Polypropylene brush insert offers highest performance and durability
Insert options include carpet, vinyl, brush, vinyl abrasive, and serrated aluminum; visit our website or consult our Product Specialists for assistance
Common Uses–interior entry ways, vestibules and foyers

Specifications

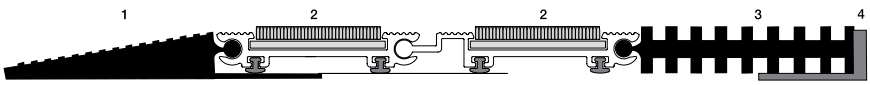
Material
6063-T52 aluminum with 49% pre-consumer recycled content and various insert options
Style
Aluminum or rubber hinges
Size
Custom made to your requirements. Consult our Product Specialists for assistance.
Options
Surface mount ramp frame or recessed frame

Possible LEED Credits

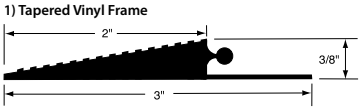
MR Credit 4 (1-2 points)
MR Credit 5 (1-2 points)
IEQ Credit 5 (1 point)

Depth

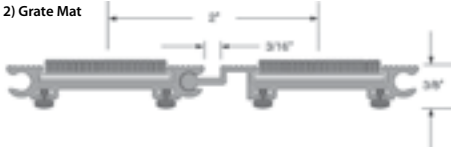
Grille Only	Grille & Ramp Frame	Grille & Deep Frame
3/8"	3/8"	7/16"



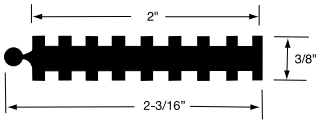
1) Tapered Vinyl Frame



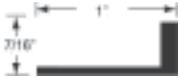
2) Grate Mat



3) Vinyl Spacer



4) Frame



Grate Mat XT

Recessed System

Features | **Zones** 1 2 3 4

The rugged benefits of a foot grille with the easy maintenance of a roll up mat

Polypropylene brush insert offers highest performance and durability

Thermoplastic hinge is weather-resistant and stays flexible–won't crack or break like PVC-based materials

Insert options include carpet, vinyl, brush, vinyl abrasive and serrated aluminum. Consult our Product Specialists for assistance.

Common Uses–interior entryways, vestibules and foyers

Specifications

Material
Corrosion-resistant 6063-T52 aluminum with 38.3-45.8% pre-consumer recycled content and various insert options fusion bonded to the backing for durability

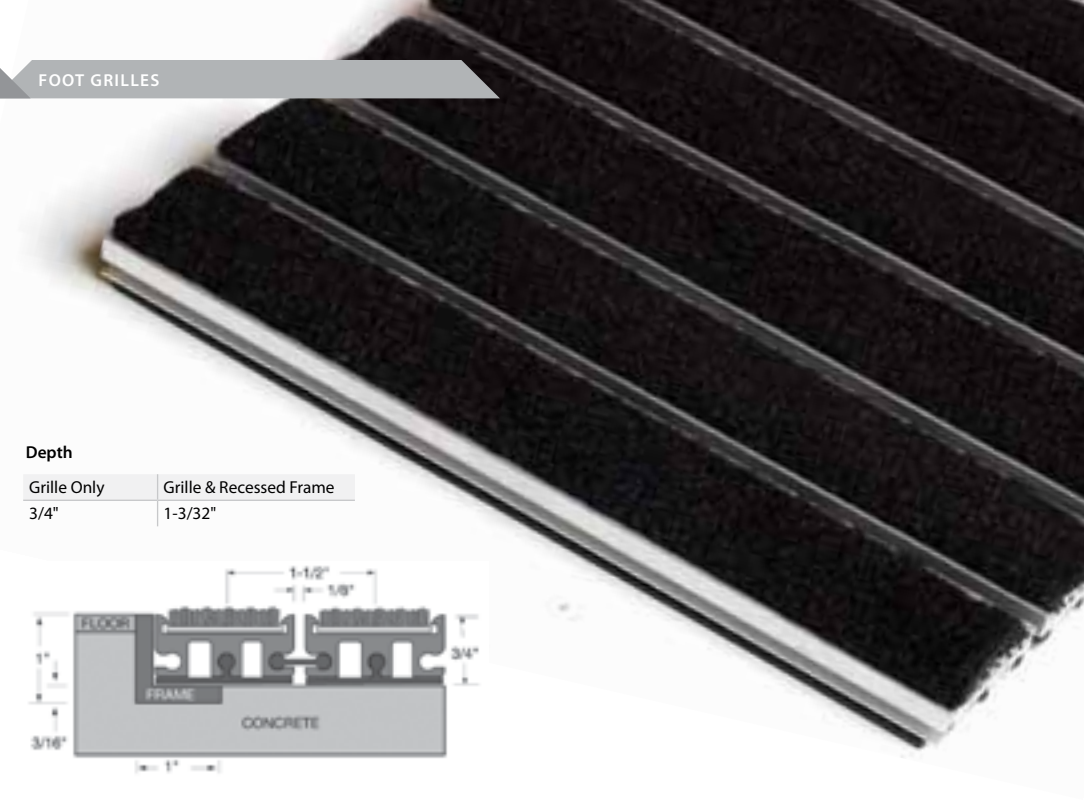
Additional Specs
6063-T52 aluminum spaced 1-1/2" on the center and connected with thermoplastic rubber hinges with 1/8" slotted holes for maximum drainage

Size
Custom made to your requirements. Consult our Product Specialists for assistance.

Maximum Rolling Load
Up to 1,000 lbs per wheel

Possible LEED Credits

MR Credit 4 (1-2 points)
MR Credit 5 (1-2 points)
IEQ Credit 5 (1 point)



Depth

Grille Only	Grille & Recessed Frame
3/4"	1-3/32"

Liberty

Surface/Shallow Recessed System

Features | **Zones** 1 2 3 4

Patented hybrid matting installs like a carpet and performs like a foot grille

Aluminum scraping bars offer both form and function that is cost-effective with an upscale look

Easily cut on-site using a grinder or jigsaw

Anti-slip backing keeps matting in place

* Liberty is also available as "Liberty Complete" with slotted drop-thru construction for cleaning underneath

Common Uses–exterior entrances, interior entryways, vestibules and foyers

miVantage™ Great durability with added aluminum strip combined with simple installation

Specifications

Material
100% solution-dyed UV stabilized polypropylene fibers with 100% premium polyamide nylon fibers (6.6), aluminum scraping inserts, 36.42% pre-consumer and 9.72% post-consumer recycled content

Backing
High density anti-slip rubber

Size
6' 7" x 32' 10"

Custom Sizes
6' 7" widths x lengths up to 32' 10"

Thickness
1/2"

Weight
176.96 oz/sq yd

Pattern
Repeat

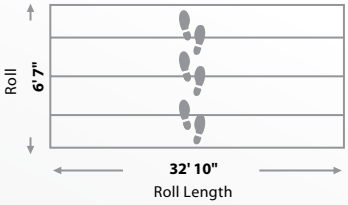
Recommended Installation
Loose lay–Ultra Flex Nosing
Glue down–Mats Inc. Multi-Bond Adhesive

Possible LEED Credits

MR Credit 4 (1-2 points)
IEQ Credit 5 (1 point) *

Charcoal

Brown



Ultra Entry™

Surface/Shallow Recessed System

Features | **Zones** 1 2 3 4

Dual strip design both scrapes off debris and absorbs moisture
Easily cut on site to any angle, arc, or shape
Durable construction withstands heavy traffic
Quiet–eliminates noise and clatter common with aluminum roll up mats
Stable–conforms to uneven sub floors
Anti-slip surface for indoor applications; ADA compliant
T section divider is optional for wheeled traffic applications
Can be used with Schlüter™ frame option

QuickShip
Gray Panel with Boston-Kenmore Charcoal insert
Common Uses–supermarkets, retail stores, malls, office buildings, schools, hospitals, sports arenas, airports

miVantage™ Great alternative to aluminum roll mats

Specifications

Material
Gray Base–27.52% pre-consumer and 1.4% post-consumer recycled content with standard Boston-Kenmore inserts
Black Base–86% pre-consumer and 1.4% post-consumer recycled content with standard Boston-Kenmore inserts. Recycled content varies with Designer Insert Options

Size
36" x 40', 48" x 40'

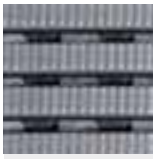
Custom Sizes
36" and 48" widths x lengths to 40'

Maximum Rolling Load
1,200 pounds per wheel

Possible LEED Credits

MR Credit 4 (1-2 points)
MR Credit 5 (1-2 points)
IEQ Credit 5 (1 point)

Panel

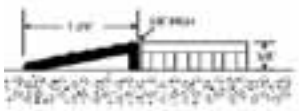

Gray


Black

Depth	Surface Ramp Frame	Recessed R or J Frame
Grille Only	3/8"	3/8"
Grille & Frame	3/8"	R: 7/16" J: 5/8"

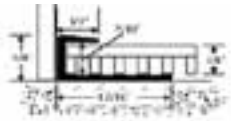
Installation Options

Surface

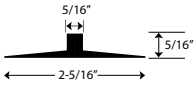

RAMP FRAME

Shallow Recessed

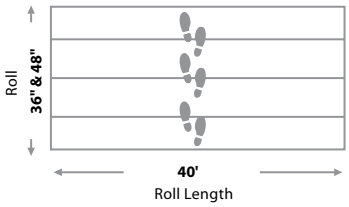

R FRAME


J FRAME

Optional Section Divider



T DIVIDER



Designer Insert Options

Enhance the beauty of the entrance system by matching Zone 3 (lobby) matting with the Foot Grille Designer Inserts in Zone 2 (vestibule). Coordinating Zone 3 matting product pages are referenced below.

Boston-Kenmore
High durability nylon fibers (6.6)

See Page 19


Brown


Charcoal


Gray


Blue

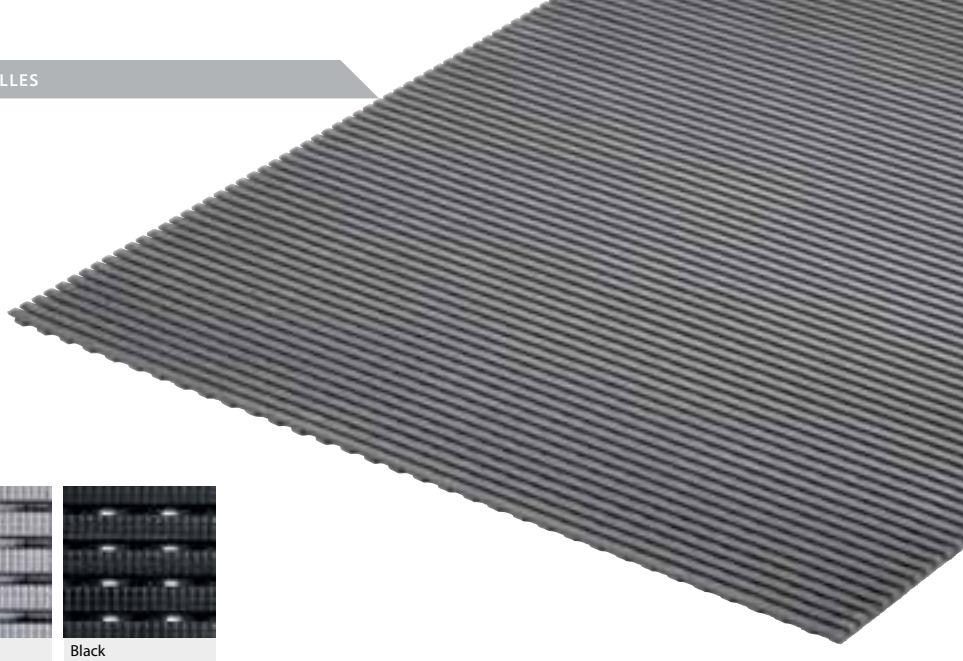
New York Collection
Premium high durability nylon fibers (6.6)

See Page 19


Charcoal

Soft Grid™

Surface/Shallow Recessed System



Features | **Zones** 1 2 3 4

Durable construction withstands heavy traffic
Easily cut on site to any angle, arc, or shape
Stable–conforms to uneven sub-floors
Quiet–eliminates noise common with aluminum roll-up mats
Anti-slip surface for indoor applications; ADA compliant
Can be used with Schlüter™ frame
Common Uses–supermarkets, retail stores, malls, office buildings, schools, hospitals, factories, airports

Specifications

Material
Vinyl drop-thru panel 100% pre-consumer recycled content in Black; 32% pre-consumer recycled content in Gray

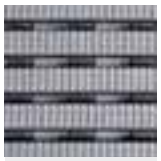
Size
36" x 30', 48" x 30'

Custom Sizes
36" and 48" widths x lengths to 30'

Maximum Rolling Load
1,200 per pounds wheel

Possible LEED Credits

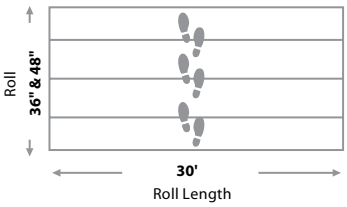
MR Credit 4 (1-2 points)
MR Credit 5 (1-2 points)
IEQ Credit 5 (1 point)



Gray
Standard Color

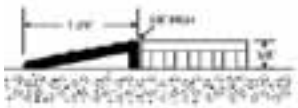
Black

Depth	Surface Ramp Frame	Recessed R or J Frame
Grille Only	3/8"	3/8"
Grille & Frame	3/8"	R: 7/16" J: 5/8"



Installation Options

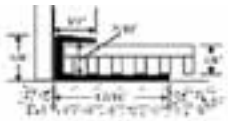
Surface



RAMP FRAME

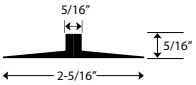
Shallow Recessed

R FRAME



J FRAME

Optional Section Divider



T DIVIDER

Legend

Features | **Zones** 1 2 3 4

Ideal for outdoors–coarse inserts scrape away dirt before it gets in the building
Drop-through design allows dirt to pass through material
Common Uses–entryways, ski resorts, sports facilities, corporate environments

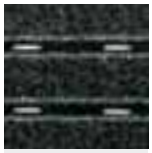
miVantage™ Great alternative to aluminum for Zone 1

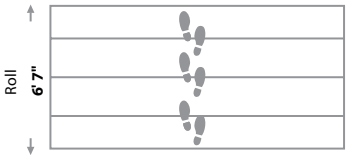
Specifications

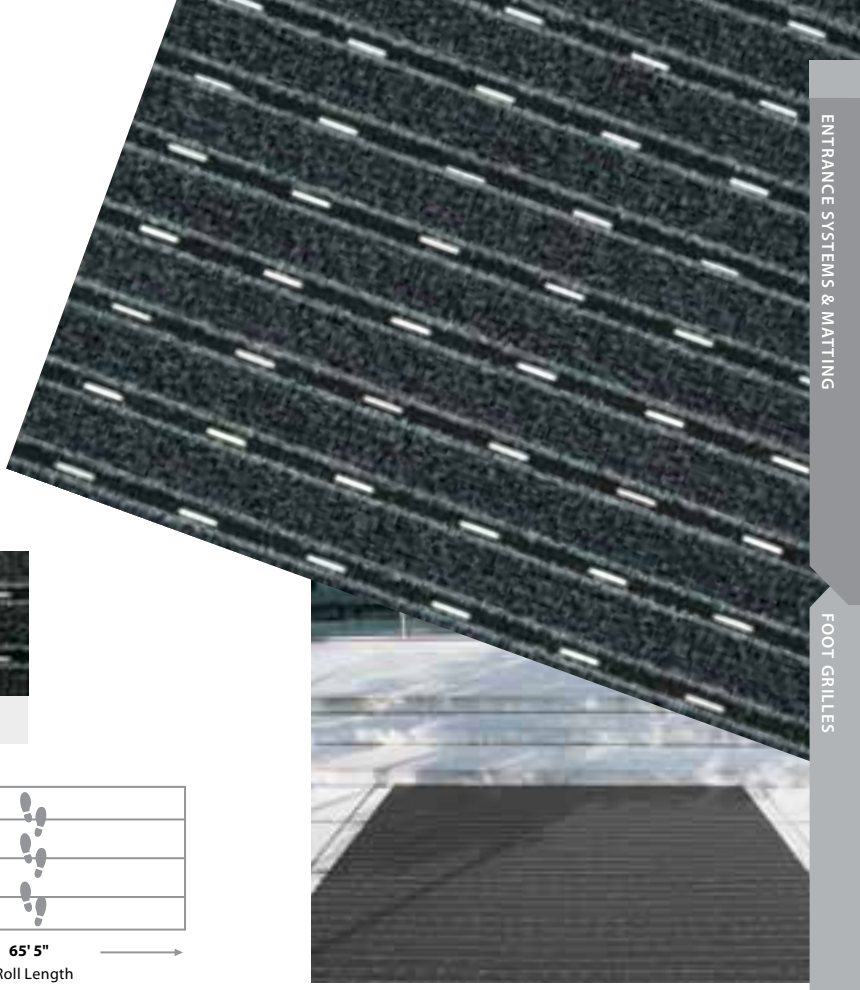
Material
Polypropylene base grid and premium polyamide nylon fibers (6.6)
Backing
High density anti-slip rubber
Size
6' 7" x 65' 5" – to accommodate rib repeat in multiple applications, figure material at 6' 5"
Custom Sizes
6' 7" width x lengths to 65' 5"
Weight
106 oz/sq yd
Thickness
9/16"
Pattern
Repeat
Recommended Installation
Loose lay–Ultra Flex Nosing
Custom Colors
Other non-stocking colors available; minimums may apply

Possible LEED Credits

MR Credit 4 (1-2 points)
IEQ Credit 5 (1 point)


Charcoal/Gray





Legacy

Features | **Zones** 1 2 3 4

Patented hybrid product installs like a carpet and performs like a foot grille
Can be cut to measure in any direction without fraying
Combines top-of-the-line fibers that both scrape dirt and absorb moisture
Inserts integrate with a variety of design schemes
Common Uses–high traffic vestibules, foyers, lobbies, retail environments

Specifications

Material
Polypropylene Base Grid and Premium Polyamide Nylon Fibers (6.6) with 5.63% post-consumer recycled content
Backing
Anti-slip rubber
Size
6' 7" x 65' 5" – to accommodate rib repeat in multiple applications, figure material at 6' 5"
Custom Sizes
6' 7" width x lengths to 65' 5"
Weight
103 oz/sq yd
Thickness
9/16"
Pattern
Repeat
Recommended Installation
Loose lay–Ultra Flex Nosing
Glue down–Mats Inc. Multi-Bond Adhesive
Custom Colors
Other non-stocking colors available; minimums may apply

Possible LEED Credits

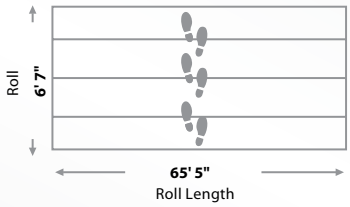
MR Credit 4 (1-2 points)
IEQ Credit 4.1 (1 point)
IEQ Credit 5 (1 point)


Blue


Charcoal Gray


Solid Black


Brown




Ultra Flex Nosing

See More Foot Grilles | *Pages 33 & 34*

SECTION 127100 - TELESCOPIC PLATFORMS

PART 1 GENERAL

1.1 SUMMARY

A. Work Included: Provide telescopic platforms for riser mounted, fold-down telescopic seating or for portable, folding chairs as required to complete the Work. Provide telescopic resilient sheeting over plywood decking or equivalent platform system made up of multiple tiers of closed deck chair platforms. Platforms shall be operable on the telescopic principal, stacking vertically in minimal floor area when not in use. All rows shall be mechanically locked, operable only when unlocking and cycling the first row. Each platform row shall be made up of a closed decking component, a complete set of supportive frames and braces as specified herein. Telescopic platforms shall be portable. Telescopic units shall be appropriately sized to minimize the weight of individual telescopic sections. Refer to the drawings for seat types, quantities, and locations.

1.2 DESIGN CRITERIA

A. Platform System:

1. Design and install all work in conformance with all applicable codes. The platform system shall be designed to support and resist in addition to their own weight the following forces:
2. Uniformly distributed live load of not less than 100 lbs. per sq. ft. of gross horizontal projections.
3. Parallel sway load of 24 lbs. per linear foot of row.
4. Perpendicular sway load of 10 lbs. per linear foot of row.

B. Guard Railings, Posts And Sockets:

1. Guard railings, posts and sockets designed to withstand the following forces applied separately:
2. 200 lbs. concentrated load applied at any point and in any direction along top rail.
3. 50 lbs. per foot applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot applied vertically downward.
4. 200 lbs. concentrated horizontal load on a 1 ft. sq. area of infilled area.

C. Basis For Calculation:

1. American Institute of Steel Construction (AISC), American Iron and Steel Institute (AISI), and Aluminum Association (AA) design criteria shall be the basis for calculation of member sizes and connections. Railing shall also meet the requirements of all applicable local codes.

1.3 BID SUBMITTALS

A. Product Data:

1. Submit manufacturer's technical data and specifications.
2. Bidders must provide a list of not less than 5 installations of similar size arenas outfitted with telescopic platforms by the proposed manufacturer with platforms of similar specification.

1.4 JOB SUBMITTALS

A. Shop Drawings: Submit shop drawings prepared from Architect's drawings and from field measurements indicating layout of platform units. Indicate size and number of seating positions, row, aisle, and stair tread widths. Shop Drawings shall also indicate railing locations, attachment details, closure panel details, and anchorage details. Drawings must also indicate field conditions including concrete joint locations.

B. Verification Samples: Submit samples for verification purposes of each exposed material from which platform units and accessories are composed, in each color, finish, pattern, and texture indicated. Include samples of the following:

1. Approved Deck
2. Carriage Wheel

C. Operating/Maintenance Manuals:

1. Provided to the owner or his representative at the time of installation. Document provided should include maintenance instructions and demonstration to owners designated personnel the correct operating procedures.
2. Provide 6 copies in heavy duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8.5" x 11" paper. Identify each binder on the front and the spine with the typed or printed title "TELESCOPIC PLATFORMS", the project title or name, and the name of the supplier. Manuals shall have a table of contents and dividers for each section of materials / information.

1.5 QUALITY ASSURANCE

A. Installer Qualification: Engage a manufacturer approved experienced installer who regularly installs and services arena telescopic platforms similar in kind, quality, quantity, schedule and extent to that indicated for this project.

B. Warranty:

1. The manufacturer shall warranty all work performed under these specifications to be free of defects for a period of one year. Starting date of warranty shall coincide with building substantial completion date.
2. Any materials found to be defective within this period will be replaced at no cost to the owner. This warranty shall not include replacements required by Acts of God, war, vandalism, flood, fire, calamity or deliberate abuse or misuse of the equipment.

C. Single Source Responsibility: Obtain telescopic platforms from a single manufacturer, including accessories, and mounting and other installation components.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver platforms in manufacturer's unopened cartons clearly labeled with manufacturer's name and contents.

B. Store platforms in dry location protected from damage and soiling under environmental conditions acceptable to manufacturer.

C. Handle platforms in a manner to prevent damage.

D. Supplier shall take sole responsibility for products from manufacture to installation and until final acceptance by owner upon completion, which will not be prior to the date for accepting the adjacent building construction.

1.7 PROJECT CONDITIONS

A. Do not install seating until space is enclosed and weatherproof, wet work in space is complete and nominally dry, installation of finishes including painting is complete, other units of work overhead are complete.

PART 2 PRODUCTS

2.1 TELESCOPIC PLATFORMS

A. Manufacturers:

1. Hussey – MXP Series Telescopic Platform, row spacing of 33” to match adjacent existing seating platforms
2. StageRight Telescopic Seating System

B. Deduct Alternates:

1. Hussey – Maxam plus series Telescopic Platform
2. Irwin – Telescopic Seating Company – Model 5000

2.2 FABRICATION

A. Dimensions: Refer to drawings for riser and tread dimensions.

2.3 UNDERSTRUCTURE SYSTEM

A. Carriage or Friction Belt drive: Ease of operation and positive engagement of adjacent vertical columns shall be achieved with manufacturers' controllable alignment system. Alignment system shall be designed to accept uneven floor conditions without binding.

B. Columns And Braces: Shall be formed high tensile steel shapes designed to fulfill design requirements. Column tubes shall be spaced apart sufficiently to eliminate any possibility of jamming due to insufficient operating clearance. Columns shall be plumb with diagonal braces attached to the lower extremity to accommodate lateral sway loads to position tracks in proper position for free rolling. Vertical column assemblies shall be of welded construction; bolted connections will not be accepted.

C. Row Interlocks: Each telescopic carriage shall be fitted with a gravity operated, low profile, vandal resistant automatic row latch. Each latch shall be actuated automatically when the adjacent "leading" carriage is extended and shall engage the adjacent "following" carriage when that carriage is, in turn, fully extended. Unlocking shall be the reverse of the locking process. Platform units shall function and support seating loads with the lower tier retracted when required to allow for disabled seating on moveable platforms.

D. Deck Stiffeners: Deck stiffeners shall be formed of high tensile steel, through-bolted to decking and spaced not to exceed 4'-0" on center. Each deck stiffener shall contain a 1-1/4" diameter nylon roller to prevent steel to steel friction.

E. Connections:

1. Welding shall be performed by welders certified in accordance with A.W.S. standards for the process employed.
2. Bolted connections shall be secured by grade 5 bolts with prevailing torque lock nuts or free spinning nuts in combination with lock washers.

F. Finish: All steel parts shall be chemically steam cleaned and spray finished with two coats rust resistant black enamel.

2.4 DECK SYSTEM

A. Lower rear riser shall be a continuous formed steel member recessed to provide full heel room and provide a continuous envelope for the deck and longitudinal support of the deck surface.

B. Front nose beam to be a continuous structural member to support design loads and provide continuous longitudinal support of the deck surface.

C. Base Bid: Panelam decking shall have a 0.030 (30 thousandths) high density polyethylene overlay, permanently bonded to structural western fir plywood in strict compliance with U.S. Product Standard PS 195. Finished thickness to be 5/8". Polyethylene finishes to be textured grey or beige. Panelam decking to have a one piece, non-slip, extruded aluminum nosing running the entire length of the platform risers. Plywood shall be supported along the front and back edge for maximum rigidity. An "H" type aluminum splice beam shall be provided between all decks. Plywood with clear or painted finish is unacceptable.

D. Decking shall be through bolted to steel supports with locking hardware. Decking attached by the use of self tapping fasteners is unacceptable.

E. Overhangs: Deck end overhangs shall not exceed vertical column location by more than 4’-0”.

F. Connections:

1. Welding shall be performed by welders certified in accordance with A.W.S. standards for the process employed.
2. Decking shall be through-bolted with extrusion clips fore/aft to the deck stiffeners and frame cantilevers. Attachment by the use of self tapping is unacceptable.
3. Finish:

a. All steel parts shall be chemically steam cleaned and spray finished with two coats of rust resistant black enamel.
b. All aluminum shall have a Grade 1, 7 mil clear anodized finish. Anodizing shall be done prior to fabrication.

2.5 PROPULSION SYSTEM

1. Operation controls on the Telescopic unit shall be a two button wired pendent. Selections shall be forward to deploy and reverse to retract unit.

a. Each drive pulley shall be direct driven by an electrical motor sized for the weight and design of unit.
b. Steering shall be accomplished by varying the relative speed of the drive motors.

2. BY OTHERS: Power to be provided behind each riser that requires power. Electrical disconnect supplied by others as required by code. Amperage to be specified by telescopic manufacturer dependent on number of drive units required.
3. Telescopic Manufacturer shall provide all wiring from provided power source to motorized system.

2.6 ACCESSORIES

A. Railings:

1. Provide aisle and side rails as indicated on the drawings
2. Sockets shall be mounted on nose beam not on end caps.
3. Finish shall be a grade 1, 7 mil clear anodized finish. Anodizing shall be done prior to fabrication.
4. Design shall comply with all applicable codes and owner shall be provided with test data and results.
5. Aisle & side rails to be self-storing.

B. Steps to be constructed of Panelam decking, and to be outlined with a one piece, non-slip, extruded aluminum nosing. Removable front step shall have "Quick Release", spring and ball pins, 1" in diameter for easy installation and removal. Bolted connection is not acceptable.

C. Gap Closures: Operating clearance "gaps" between sections shall be covered with hinged plates (attached to one section). Closure pieces shall also be provided at the leading edge of the lower deck to the back side of the dasher panels.

D. Power System / Stage side telescopics: System shall be capable to be equipped with an integral, fully automatic propulsion system to open and close telescopic platform.

E. Provide air system for moving portable sections.

F. Skirting: Provide skirting at the ends of all exposed telescopic seating locations.

PART 3 EXECUTION

3.1 FIELD INSPECTION

A. Verify that areas to receive products are free of impediments interfering with installation that are not part of the building design. Do not begin work until conditions are satisfactory.

3.2 PREPARATION

A. Supplier shall be responsible for field checking site conditions and dimensions.

3.3 INSTALLATION

A. Install products in accordance with manufacturer’s instructions and approved submittal drawings.

3.4 ADJUSTMENT AND CLEANING

A. All equipment to be cleaned and adjusted for smooth and proper operation.

B. Clean work area and remove debris from site on a daily basis.

3.5 MAINTENANCE AND OPERATION

A. Instructions in both operation and maintenance shall be transmitted to the owner or his/her representative by the manufacturer of the telescopic platforms.

B. Maintenance and operation of the telescopic platform system, after substantial completion and acceptance, shall be the responsibility of the owner or his authorized representative.

END OF SECTION 127100

SECTION 127200 - FOLD-DOWN TELESCOPIC PLATFORM SEATING

PART 1 GENERAL

1.1 SUMMARY

A. Work Included: Provide riser-mounted fold-down telescopic platform seating as shown on the Drawings and specified herein, or as required to complete the Work. Provide chairs with upholstered seats and padded backs, with spring assisted semi-automatic operations. Chairs shall be comprised of double wall, blow molded, high-density polyethylene seats and backs with padded upholstered inserts.

B. Manufacturers: Company shall specialize in the manufacturing of arena spectator seating equipment. Subject to compliance with requirements, provide products by one of the following for fold-down telescopic platform chairs, or approved equal:

Manufacturer:	Base Bid – Telescopic seating semi-automatic, upholstered recessed padded inserts	Deduct Alternate - East Telescopic seating, semi-automatic, upholstered recessed padded inserts
.1 American	Spirit 33 5/8	Dimension Plastic non-upholstered
.2 Hussey	Forward Fold Quattro	Metro
.3 Irwin	Forward Fold Down Citation	Integra

1.2 BID SUBMITTALS

A. Example Installations: Bidders must provide a list of not less than 5 installations of similar size arenas of stadiums seated by the proposed manufacturer with chairs of similar specification.

B. Test Results: Supplier must provide certified test reports from a certified test lab. Test reports shall be submitted with bid proposal. Any bid received without the test reports shall be deemed non-responsive.

C. Product Data: Submit to contractor for review and approval manufacturer's technical data for fold down telescopic platform seating.

1.3 JOB SUBMITTALS

A. Shop Drawings: Submit shop drawings indicating layout of seating units, chair sizes, aisle width, row width available for exiting, row letters and seat numbers.

B. Verification Samples: Submit to Architect samples for review and approval each exposed material from which seating units and accessories are composed, in each color, finish, pattern, and texture indicated. All exposed materials shall match those of the Arena Fixed Seating. Include samples of the following:

1. Fabric.
2. Metal components.
3. Molded plastic.
4. Exposed fasteners.

1.4 QUALITY ASSURANCE

A. Installer Qualification: Engage a manufacturer approved experienced installer who regularly installs and services arena type seating similar in kind, quality, quantity, schedule and extent to that indicated for this project.

B. Warranty

1. The manufacturer shall warranty all work performed under these specifications to be free of defects for a period of one year from the date of substantial completion and acceptance of the adjacent building structure and telescopic platforms.
2. Any materials found to be defective within this period will be replaced at no cost to the Owner or his successors in interest. This warranty shall not include replacements required by Acts of God, war, vandalism, flood, fire, calamity or deliberate abuse or misuse of the equipment.

C. Single Source Responsibility: Obtain each type of seating from a single manufacturer, including accessories, and mounting and other installation components.

D. Seating Layout: Design and install seating to conform with project requirements in a manner that produces a seating layout with standards placed laterally in each row so that end standards are in alignment from first to last row. See drawings for seating widths.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver seating in manufacturer's unopened cartons clearly labeled with manufacturer's name and contents.

B. Store seating in dry location protected from damage and soiling under environmental conditions acceptable to manufacturer.

C. Handle seating in a manner to prevent damage.

D. Supplier shall take sole responsibility for products from manufacture to installation and until final acceptance by Owner upon completion of the Project.

1.6 PROJECT CONDITIONS

A. Do not install seating until space is enclosed and weatherproof, wet work in space is complete and nominally dry, installation of finishes including painting is complete, other units of work overhead are complete.

1.7 EXTRA MATERIALS:

A. Deliver extra materials to Owner. Furnish extra materials described below matching Products installed, packaged with protective covering for storage and identified with labels clearly describing contents.

B. Furnish spare equipment for chairs for each width in colors in the same proportion as these colors occur in the overall installation. Furnish quantities as follows:
1. Seat and Back Chair Assemblies 4
2. R.H. Armrest Assemblies 2
3. L.H. Armrest Assemblies 2

4.	Center Armrest Assemblies	2
5.	Plastic Armrests w/Caps	4
6.	Plastic Arm post Covers	4
7.	Seat Inserts	8
8.	Back Inserts	8

PART 2 PRODUCTS

2.1 MATERIAL SPECIFICATIONS

A. Manufacturers:

1. American Seating
2. Hussey
3. Irwin
4. Substitutions: Section 016000 – Product Requirements

B. Seat Schedule:

1. Forward-Fold Seating:

Manufacturer		Style
a.	American	Dimension 675
b.	Hussey	Forward-Fold Quattro
c.	Irwin	Forward-Fold Citation

C. Steel: All steel shall have smooth surfaces and be designed of sufficient gauge thickness to withstand strains of normal use.

D. Padding Material: Seat and back padding material shall be of new (prime manufacturer) polyurethane foam.

E. Cast Iron: Shall be gray cast iron conforming to ASTM 48-48 Class 25 (25,000 PSI) minimum strength, and shall be free of blow holes and hot checks with parting lines ground smooth and shall be free of inordinately rough surfaces. Provide notarized certification that cast iron is 25,000 PSI.

F. Fabric

1. General Seating

a. Fabric Line: Absecon Mills
b. Fabric Pattern: Sidestep
c. Fabric Name: Redrock
d. Content: 100% polyester,
e. Repeat: None
f. Width: Approximately. 54 inches.
g. Weight: 13.8oz. / lin. Yard.
h. Colorfastness to Light: Class 5, 40 hours
i. Colorfastness to Crocking :
   1) Dry: Class 4.5.
   2) Wet: Class 4.

j. Abrasion: 100,000 Double Rubs.
k. Cleaning Code: W – Use a water based cleaner
l. Flame Resistance:

1) CAL 117-E: Passes.
2) NFPA 260-1989-Class 1
3) BIFMA X5.7-1991
4) UFAC: Class 1.

2. Club Seating

a. Fabric Line: Absecon Mills
b. Fabric Pattern: Sidestep
c. Fabric Name: Redrock
d. Content: 100% polyester,
e. Repeat: None
f. Width: Approximately. 54 inches.
g. Weight: 13.8oz. / lin. Yard.
h. Colorfastness to Light: Class 5, 40 hours
i. Colorfastness to Crocking :

1) Dry: Class 4.5.
2) Wet: Class 4.

j. Abrasion: 100,000 Double Rubs.
k. Cleaning Code: W – Use a water based cleaner
l. Flame Resistance:

1) CAL 117-E: Passes.
2) NFPA 260-1989-Class 1

G. Injection Molded Plastic: Plastic shall be one-piece high impact, linear polyethylene with built in ultraviolet light inhibitors to retard fading. Color: to be selected by Architect from manufacturer's standard colors.

H. Finish

1. Metal Parts: Aluminum and steel components shall be chemically cleaned and finished with an electro statically applied polyester powder coat finish. Color: to be selected by Architect from manufacturer's standard colors.
2. Plastic Parts: Shall be pigmented with textured surface. Color: to be selected by Architect from manufacturer's standard colors.
3. Hardware: All assembly hardware shall be rust resistant and painted to match metal parts.

2.2 PERFORMANCE TESTING

A. Seats: Vertical Drop Test of a forty-pound sandbag dropped 100,000 times on the seat pan. 600 pounds evenly distributed on the seat pan.

B. Backs: Swinging Impact Test of two forty-pound sandbags impacting the chair 60,000 times. 350 pounds evenly distributed to the front of the chair back.

2.3 MATERIALS / FABRICATION

A. Seat Pans and Backs: Seat and back shall be one piece, double wall, blow molded, high-density polyethylene with a nominal wall thickness of 1/8" per wall. Material shall be color pigmented to match the arena fixed seating. Color as selected by Architect from Manufacturer's standard range.

B. Upholstered Seat / Backs: Seats and backs to receive upholstered inserts, which are securely fastened to the blow-molded plastic seats and backs. Inserts include bases, polyform pads (minimum 1/2" seat back and 1/2" seat pan) and selected fabric. No exposed fasteners will be permitted on the top of the seat or front of the back.

C. Seat / Back Support: Seat / back supports shall be 11 gauge steel brackets attached to the seat and seat back with screws threaded into inserts. Stafast insert nuts to be molded into the plastic seat and back to achieve torque and pullout strength requirements. Through fasteners are not acceptable. The supports shall pivot in nylon bushings engineered for maintenance free operations.

D. Chair Standards: The chairs shall be supported by die cast aluminum, steel or caste iron standards. The standards shall be firmly attached to the steel chair mounting beams. The top of the arm posts shall be designed to secure the armrests.

E. Semi-Automatic Operation: Platform chairs to be attached to steel mounting beams in groups of up to 14 chairs. When the telescopic platform is open, the chair groups shall be manually rotated into the upright locked position. The rise-up operation to be spring assisted to reduce manual effort required. When the telescopic platform is closing, the chairs shall automatically release from the upright position and lower to the stored position. First row chairs groups shall require manual unlocking.

F. Accessories:

1. Row Identification Plates: Anodized aluminum plates 2-3/4" x 1-3/4" x .020" thick to be attached with two rivets. Numbers shall be 1-1/4" high Helvetica type, finished in black.
2. Seat Identification Plates: Anodized aluminum seat pan number plates 2" x 5/8" x .020" thick to be attached with two rivets for easy seat identification in the unoccupied condition. Numbers shall be 7/16" high Helvetica type, finished in black.
3. Armrest: Lifting armrests shall be provided for one percent of fixed seating capacity or 5% of the aisle seats (whichever is greater). Each accessible chair shall include the universal handicap symbol on the end aisle standard for clear identification.
4. Drink Holders (Alternate): Plastic cup holders shall be mounted to the backs of the chairs at each intermediate standard.

PART 3 EXECUTION

3.1 FIELD INSPECTION

A. Verify that areas to receive products are free of impediments interfering with installation.

B. Do not begin work until conditions are satisfactory to the Supplier.

3.2 PREPARATION

A. Seating supplier shall be responsible for field checking and verifying site conditions and dimensions.

B. Where differences exist between job site and plan, which might require changes in product, size, or seat count, it shall be the responsibility of the seating supplier to coordinate with the building contractor to arrange appropriate adjustments in both contract price and delivery prior to shipment. These conditions should be made known to the Architect in writing prior to making any adjustments that might affect the contract price or delivery date of materials.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions and approved submittal drawings.

3.4 ADJUSTMENT AND CLEANING

A. All equipment to be cleaned and adjusted for smooth and proper operation.

B. Clean work area and remove debris from site on a daily basis.

3.5 MAINTENANCE AND OPERATION

A. The manufacturer of the seating or his representative shall transmit instructions in both operation and maintenance to the owner.

B. Maintenance and operation of the seating system after substantial completion and acceptance shall be the responsibility of the owner or his designated representative.

END OF SECTION 127200

SECTION 127300 - FIXED ARENA SEATING

PART 1 GENERAL

1.1 SUMMARY

A. Fixed arena bowl seating.

1. Riser mounted upholstered chairs.
2. Provide floor mounted chairs only where indicated on the drawings or otherwise required due to mounting conditions.

B. Alternate: Provide alternate price for replacement of seat pans and backs only. New seat pans and backs shall be installed onto existing stanchions. Include full replacement of the minimum number of aisle chairs required to have lifting arm rests per 2.3, F, 1.

1.2 BID SUBMITTALS

A. Example Installations: Bidders must provide a list of not less than 5 installations of similar size arenas or stadiums seated by the proposed manufacturer with chairs of similar specification.

B. One sample of each chair proposed shall be sent to the Cumberland County Civic Center in Portland, Maine for bid evaluation.

C. Test Results: Supplier must provide certified test reports from a certified test lab. Test reports shall be submitted with bid proposal.

D. Check List: Any deviations or exceptions to the specifications should be noted and accompany cost proposals. Award of a contract will be subject to review of the noted exceptions, aesthetics, functionality, and cost by the Owner and the Architect.

E. Product Data: Submit manufacturer's technical data for each type of arena seating.

F. Provide a unit cost to add drink holders to the fixed seating.

1.3 JOB SUBMITTALS

A. Shop Drawings: Submit shop drawings prepared from Architect's drawings and from field measurements indicating layout and number of seating units, chair sizes, aisle width, row width available for exiting, row letters and seat numbers. Drawings must also indicate field conditions including precast concrete unit joint locations.

1.4 VERIFICATION SAMPLE:

A. Submit samples for verification purposes of each exposed material from which seating units and accessories are composed, in each color, finish, pattern, and texture indicated. Include samples of the following:

1. Fabric.
2. Powder coat finishes for metal components.
3. Molded plastic.

4. Exposed fasteners.
5. Expansion Anchor.

1.5 QUALITY ASSURANCE:

A. Installer Qualification: Engage a manufacturer approved, experienced installer who regularly installs and services arena type seating similar in kind, quality, quantity, schedule and extent to that indicated for this project.

B. Warranty: The manufacturer shall warranty all work performed under these specifications to be free of defects for a period of one year. Any materials found to be defective within this period will be replaced at no cost to the owner. This warranty shall not include replacements required by Acts of God, war, vandalism, flood, fire, calamity or deliberate abuse or misuse of the equipment.

C. Single Source Responsibility: Obtain each type of seating from a single manufacturer, including accessories, and mounting and other installation components.

D. Seating Layout: Design and install seating to conform with project requirements in a manner that produces a seating layout with standards placed laterally in each row so that end standards are in alignment from first to last row. Refer to the Drawings for standard seat width for each type of fixed arena seating. The smallest width seats in a row shall be located adjacent to the aisle.

E. Design Criteria: These specifications are based on the specific type and models of seats indicated. Seating by other manufacturers is acceptable, providing they have the same performance characteristics as judged by the Architect. The burden of proof for equality of each type of seat is on the proposer.

F. Mockups: A two row mock-up of the proposed chairs shall be installed onto existing stadia at a location determined by the Owner. Include a minimum of 3 chairs in each row. Adjust seat position and back pitch as directed by the Architect to achieve appropriate row spacing. For each different floor mount condition, install one floor mount seat and one seat in the row immediately in front. Adjust seat position and back pitch as directed by the Architect to achieve appropriate row spacing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver seating in manufacturer's unopened cartons clearly labeled with manufacturer's name and contents.

B. Store seating in dry location protected from damage and soiling under environmental conditions acceptable to manufacturer.

C. Handle seating in a manner to prevent damage

D. Supplier shall take sole responsibility for products from manufacture to installation and until final acceptance by owner upon completion.

1.7 PROJECT CONDITIONS

A. Do not install seating until space is enclosed and weatherproof, wet work in space is complete and nominally dry, installation of finishes including painting is complete, other units of work overhead are complete.

1.8 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage and identified with labels clearly describing contents.

B. Furnish spare equipment for each width and color of seat in the same proportion as these widths and colors occur in the overall installation. Furnish quantities as follows:

1. Back Assemblies

a.	Complete Backs - Upholstered inner panel and plastic shell.	15
b.	Upholstered Back Inner Panel	5
c.	Plastic Shell	15

2. Seat Assemblies

a.	Complete Seats – Upholstered seat frame, foundation and hinges	15
b.	Upholstered Seat Frame	5
c.	Plastic Seat Frame	10

3.	Intermediate Standards	10
4.	End Standards	6R+ 6L
5.	Armrests	20
6.	Row and Seat Identification (qty. of each letter and number used)	2
7.	Hinge Pivot (R&L extension, proportioned to installation)	10

PART 2 PRODUCTS

2.1 MATERIAL SPECIFICATIONS

A. Manufacturers:

1. American Seating
2. Hussey
3. Irwin
4. Substitutions: Section 01 60 00 - Product Requirements.

B. Seat Schedule

1. General Seating:

Manufacturer		Style	Back height (inches)
a.	American	Stellar 220	32.5
b.	Hussey	Quattro	33.0
c.	Irwin	Citation	32.0

2. Club Seating:

Manufacturer		Style	Back height (inches)
a.	American	Stellar 220	32.5

b.	Hussey	Quattro	33.0
c.	Irwin	Citation	32.0

3. General Requirements:

a.	Seat Cushion (at front edge)	3”
b.	Back Cushion	2”
c.	Pitch of seat back	Varies: 12 deg to 16 deg
d.	Arm rest width	2”
e.	Automatic fold	Yes

C. Steel: All steel shall have smooth surfaces and be designed of sufficient gauge thicknesses to withstand strains of normal use and abuse.

D. Padding Material: Seat and back padding material shall be of new (prime manufacture) polyurethane foam.

E. Wood: Plywood, exposed or concealed, shall be hardwood. All plywood shall be hot press laminated using high frequency process. Interior plys shall be Class 3 or better. Exposed exterior plys shall be Class 1. Particle core shall be 55 pound density.

F. Cast Iron: Shall be Grey cast iron conforming to ASTM 48-48 Class 25 (25,000 PSI) minimum strength, and shall be free of blow holes and hot checks with parting lines ground smooth and shall be free of inordinately rough surfaces. Provide notarized certification that cast iron is 25,000 PSI.

G. Fabric:

1. General Seating

a. Fabric Line: Absecon Mills
b. Fabric Pattern: Sidestep
c. Fabric Name: Redrock
d. Content: 100% polyester,
e. Repeat: None
f. Width: Approximately. 54 inches.
g. Weight: 13.8oz. / lin. Yard.
h. Colorfastness to Light: Class 5, 40 hours
i. Colorfastness to Crocking :

1) Dry: Class 4.5.
2) Wet: Class 4.

j. Abrasion: 100,000 Double Rubs.
k. Cleaning Code: W – Use a water based cleaner
l. Flame Resistance:

1) CAL 117-E: Passes.
2) NFPA 260-1989-Class 1
3) BIFMA X5.7-1991
4) UFAC: Class 1.

2. Club Seating

a. Fabric Line: Absecon Mills
b. Fabric Pattern: Sidestep
c. Fabric Name: Redrock
d. Content: 100% polyester,
e. Repeat: None
f. Width: Approximately. 54 inches.
g. Weight: 13.8oz. / lin. Yard.
h. Colorfastness to Light: Class 5, 40 hours
i. Colorfastness to Crocking:

1) Dry: Class 4.5.
2) Wet: Class 4.

j. Abrasion: 100,000 Double Rubs.
k. Cleaning Code: W – Use a water based cleaner
l. Flame Resistance:

1) CAL 117-E: Passes.
2) NFPA 260-1989-Class 1

H. Injection Molded Plastic: Plastic shall be one-piece high impact, linear polyethylene with built in ultraviolet light inhibitors to retard fading. Color as selected by Architect from Manufacturer's standard range.

I. Finish:
1. Metal Parts: All exposed metal parts shall be powder coated with an epoxy powder coat finish. The powder coat finish shall be applied by electrostatic means to a thickness of 3 mils, and shall provide a durable coating having a 4H Pencil hardness. Prior to powder coating, metal parts shall be treated with a five-stage bonderization process for superior finish adhesion, and after coating shall be oven baked to cause proper flow of the epoxy powder to result in a smooth, durable finish. Color as selected by Architect from Manufacturer's standard range.
2. Plastic Parts: Color as selected by Architect from Manufacturer's standard range.
3. Hardware: All assembly hardware shall be rust resistant, painted black to match metal parts.

2.2 PERFORMANCE TESTING

A. Test 1 - Vertical Drop Impact Test To Seat:

1. Test Sample: Three Unit Upholstered Seat and Back Auditorium Chair.
2. Test Description: This test consists of repeated impacts of a forty-pound 10" diameter sand bag dropped on the set at an approximate rate of 19 impacts per minute. The center of impact is to be at the center of the seat. The chair tested shall be the middle chair of a three-seat assembly.
3. Tolerances:

a. Bag weight plus or minus one pound.
b. Bag diameter plus or minus one inch.

4. Test Criteria: The bag shall be dropped as follows:

    a. 25,000 times from a height of 6"
    b. 25,000 times from a height of 8”
    c. 25,000 times from a height of 10"
    d. 25,000 times from a height of 12"

5. Acceptance Criteria: Measurements of the seat height are to be taken at the completion of the first 100 impacts and then at the completion of the test. The height of the seat measured at the front edge shall not drop more than 3/4". There shall be no loosening of the riser fastenings or of the pivots, which retain the set to standards. The seat must be able to return to normal fold position.

B. Test 2 - Swinging Impact Test:

1. Test Sample: Use the same three-chair assembly as previously used for the vertical drop impact tests except for the following changes: Rearrange the setup so that the two (outside) outer standards become the middle standards, one outer seat and back shall comprise the middle chair. The previously tested middle chair parts are to be used for the outer (right and/or left) chairs.
2. Test Description: This test consists of repeated impacts to the chair back of two, 40- pound, 10" diameter sand bags. The bags mounted at 13" centers are to be pivotally hung from a horizontally reciprocating actuating bar cycling at approximately 37 strokes per minute. The sand bags are to be filled with dry sand and hang with the bottom of the bag 32" below the pivot suspension point and 10" below the top of the chair back. The chair back is to be centered between the bags when the bags are in the center of the stroke.
3. Tolerances:

    a. Bag weight plus or minus one pound
    b. Bag diameter plus or minus one inch

4. Test Criteria: The number of impacts and the horizontal stroke of the actuating bar shall be as follows:

    a. 10,000 impacts (cycles) through a distance of 5"
    b. 30,000 impacts (cycles) through a distance of 7"
    c. 10,000 impacts (cycles) through a distance of 9"
    d. 10,000 impacts (cycles) through a distance of 12"

5. Acceptance Criteria: At the completion of the test, the middle standards shall have demonstrated sufficient strength and durability to withstand the test without failure or irregularities that would impair the unit's usefulness. Also, no visible evidence of failure or irregularities shall have occurred in the seat or back of the unit.

C. Test 3 - Static Load Test To Seat:

1. Test Sample: A single floor mounted chair unit.
2. Test Description: A vertical static load is to be applied to the top of the seat with the center of the load approximately 3" from the front edge and equal distance from the sides. A beam (2" x 4") is to be used to distribute the load transversely across the seat.
3. Test Criteria: The test load of 600 pounds is to be applied at the rate of approximately 2 pounds per minute.

4. Acceptance Criteria: Chair must withstand a minimum load of 600 pounds with a permanent distortion not to exceed 5/8". Deflections and permanent distortions are to be measured at the front center edge of the seat.

D. Test 4 - Self-Lifting Seat Oscillating Test:

1. Summary: The principle of the test method is to test the reliability of the seat-lifting mechanism of the auditorium chair seat. Three randomly selected from a standard production run are to be tested. Test battery is to be completed within a period not exceeding 14 days. This test method conforms to ASTM F-851-87, Standard Test Method for Self-Raising Seat Mechanisms.
2. Test Description: The seat shall be lowered mechanically against the down stop, and then released at a reasonable cyclical rate by means of a hard rubber roller attached to the end of an actuating bar. The roller shall be 3-1/2" in diameter and shall contact the center of the seat approximately 5" to 5-1/2" from the rear edge. The mechanism shall allow the seat to cycle freely through its full operation.
3. Test Criteria: 100,000 Cycles, minimum, within 14 day test period. Dimension of seat in raised position relative to the back of the chair shall be measures at the beginning of the test and after 100,000 cycles. After measurement of seat position, cycling may continue, and total cycles to failure may be reported.
4. Acceptance Criteria: At the completion of the test, the seats shall have demonstrated sufficient strength and durability to withstand 100,000 test cycles without any appreciable loss to the seat's self-rising action or excessive loosening of components, and dimensional deviation to the front of the seat shall not exceed 1-1/2".
5. Rationale: The rationale for 100,000 cycles of the seat-lifting mechanism is that 100,000 cycles are equal to approximately 11 cycles per day, 365 days per year, for 25 years. The average life expectancy of an auditorium chair in the typical assembly space does not exceed 25 years.

2.3 FABRICATION

A. Upholstered Self-Lifting Seats:

1. Plastic:

a. Seats shall be upholstered on their face with polyurethane foam, injection molded polypropylene foundation, and shall be quietly and automatically self-lifting to a 3/4 fold position when unoccupied. Seats shall be ISO 9001 certified through routine testing during manufacturing to pass seat cycle oscillation testing, ASTM Designation F851-87 Test Method for Self-Rising Seat Mechanism, and 600 lb. static load to front of seat testing.
b. The seat cushion shall have an extended front, high resilient polyurethane foam pad, molded to the contour on the bottom and providing a flat surface on the top of the cushion with a crisp, waterfall leading edge. Height of the cushion at the front edge shall be consistent at approximately 3-1/2" above the foundation. The specified fabric, carefully tailored, shall be of panel-side construction, secured around the perimeter of the cushion frame by means of a drawstring and staples. The seat cushion assembly shall be securely locked to the seat foundation, preventing unauthorized removal; but facilitating convenient removal by trained maintenance personnel.
c. Seat foundation shall be 25% glass-filled injection molded polypropylene, strengthened by deep internal ribs and gussets, completely enclosing the self- lifting hinge mechanism. The seat shall rotate on two molded, structural, glass- filled nylon hinge

rods in internally molded channels with integral downstops for exceptional strength. Seat-lift shall be accomplished by compression springs and lubricated plastic cams, providing quiet gentle seat uplift.

d. When unoccupied, the seat shall quietly and automatically rise to a 3/4 fold position, and upon a slight rearward pressure, shall achieve full-fold, allowing the patron additional passing room. Downstops and upstops shall be non-metallic, eliminating plangent noise and providing quiet operation.
e. Bottom cover of the seat shall be glass-filled, injection molded polypropylene with textured surface, matching other plastic components in color

2. Upholstered Seat Frame:

a. Padding shall consist of an integrally molded polyurethane foam pad. It shall be non-hardening and non-oxidizing. It shall resist acids, alkalis, oils, greases, soaps, abrasions, moisture mildew and tearing.
b. The upholstery cover shall be of a panel side construction without welts and shall be fastened to the frame without the use of nails, tacks or screws, thereby providing for easy reupholstering. It shall be possible to remove the upholstery portion of the seat from the steel foundation without removing the complete seat from the chair.

3. Upholstered Backs:

a. Backs shall be padded and upholstered, consisting of a one- piece molded plastic outer panel and a curved steel, wood or other appropriate inner upholstery panel.
b. The outer panel shall be molded plastic, high impact-resistant with textured outer surface, formed to enclose the edges of the inner upholstery panel at the top and on both sides of the back, and shall not be less that 26" in length, extending below the seat level to protect the seat cushion. There shall be no exposed screws above the armrests. Back wings for attaching the back to the standards shall not be less than 14 gauge steel.
c. The upholstery materials shall be placed over a polyurethane foam pad. The foam pad shall be securely cemented to the inner panel and the upholstery shall be securely fastened to the back of the panel.

4. Seat Hinges:

a. Seat hinge shall be completely enclosed in seat assembly and shall automatically fold to a 3/4 uniform position at all times without adjustment. It shall also fold 100% to provide additional clearance when necessary.
b. Each of the independent seat hinges shall be fitted with neoprene cushioned up and down stops, as well as double acting, self-centering, pre-loaded coiled seat return springs with silencer.
c. Seat hinge and spring installation shall be designed not to require periodic adjustment or lubrication.

5. Arm Rests: Arm rests shall be provided for each center standard and aisle standard and shall be molded semi-rigid polyethylene plastic.
6. Chair Assembly:

a. All welds shall be made at the factory by welders who are certified on the equipment and to the process used.
b. All structural connections shall be made with the S.A.E. Stress rated finish grade plated steel bolts, lock washers and nuts.

B. Riser Mounted Standards:

1. Cast Iron Standards: Standards shall be of gray iron of open panel, vertical mount design to minimize damage from possible earth tremors. Horizontal mounts are not acceptable. The front member of the lower portion of the standard shall allow 4" clear to provide ample cleaning clearance for sweeping the tread beneath chair assembly. The rear member of the lower portion of the standard shall be so designed to allow it to be directly attached to the riser without the use of shims or filler strips. Riser standards shall be securely attached to the riser at not less than two points, and there shall be no projection of any portion of the standards or any clamp upon the tread to form a stumbling hazard or to interfere with sweeping the treads. Standards shall be provided with two lugs for attachment of armrest.
2. Cast Iron End Standard Treatment:

    a. End standards shall be solid cast iron casting.

3. Welded Steel Standards:

    a. Standards shall be fabricated of 14 gauge steel to a 1" x 3" rectangular column. The top of the column shall be provided with two formed steel dovetails for secure attachment to the armrests. A wing plate of 14 gauge steel shall be welded to the column to provide for attachment of the back. Brackets for seat attachment shall be of heavy gauge steel welded on each side of the standard or a common bracket welded to the center of the standard.
    b. A steel attaching plate shall be welded to the bottom of the rectangular column. The standard shall be fabricated to extend back to the face of the riser, at an appropriate angle to provide proper seat and back height and angle. The steel attaching plate shall attach directly to the face of the riser and be a vertical mount design to minimize damage from possible earth tremors. Horizontal mounts are not acceptable. All welding shall be gas shielded, arc weld. The front member of the lower portion of the standard shall allow 4" clear to provide ample cleaning clearance for sweeping the tread beneath chair assembly.

4. Welded Steel End Standard Treatment:

    a. Aisle standards shall be clean, open design, without decorator panel. Standards shall be fabricated of 14 gauge steel, 1" x 3" rectangular column. Bracket for seat attachment shall be of heavy 11 gauge steel welded to standard.

C. Concrete riser attachment:

1. Chair stanchions shall each be attached by means of two 3/8" expansion bolts set in holes drilled to a depth of not less than 2-1/4" in the concrete. Precast seat unit reinforcing steel is located 2-1/2" clear from the face of riser (typical).
2. Anchor attachment shall be designed to support a 600 pound load per chair.
3. Provide the minimum edge distance at precast unit joints as recommended by anchor manufacturer. Submit product data for Architects approval.
4. Expansion bolts shall be approved type lead drive anchor comprised of the following components:

    a. Bolt - 3/8" x 3-1/2" expansion anchor.
    b. Sleeve - 3/8" I.D. x 1" lead (commercially known as 2% antimony lead) with one end recessed to fit cone.

c. Cone - Cast hard metal and steel setting washer.
d. Flat washer to be slipped on bolt over the standard and nut to be permanently secure by means of the lock washer.

D. Concrete Floor Attachment (where required):

1. Chair standards shall be attached by means of two ¼" (6mm) expansion bolts set in holes drilled to a depth of not less than 1 ¾" (44mm) in the concrete.
2. Expansion bolts shall be of approved type lead drive anchor comprised of the following components:

a. Bolt – ¼" (6mm) x 3" (76mm) or as required expansion anchor.
b. Sleeve – ¼" (6mm) I.D. x 1" (25mm) or as required lead (commercially known as 2% antimony lead) with one end recessed to fit cone. One sleeve per bolt.
c. Cone – Cast

3. Coordinate length and depth of expansion bolts with recommendations of both precast concrete manufacturer and permanent fixed seating system manufacturer.

E. Accessories:

1. Include ADA compliant, lifting armrests for a minimum of:

a. 5% of all aisle seats, or
b. 1% + 1 of all fixed seats, whichever is greater.
c. Each accessible chair shall include the universal handicap symbol on the end aisle standard for clear identification.
d. Chairs with lifting armrest shall be evenly distributed throughout the facility.

2. Row and Seat Identification Plates:

a . Plates shall be made of clear anodized aluminum of.025 inch thickness. Letters or numbers shall be recessed and filled with baked, black enamel.

1) Seat number plates shall be 1-1/2" x 5/8" minimum, with 36 point Helvetica medium numbers.
2) Row letter plates shall be 2" x 2" minimum, with 72 point Helvetica medium letters.

b . Chair numbers shall be provided with 2 holes for attachment to a recessed area in the front of the steel seat pan and secured with 2 tamper-proof connectors.
c . Row letters shall be provided with 2 holes for attachment to an area in the end standard and secured with 2 tamper-proof connectors.
d . Drink Holders (Alternate): Plastic cup holders shall be mounted to the backs of the chairs at each intermediate standard. Attach to 14 gauge fabricated steel bracket and fastened to intermediate standard with back attachment hardware.

1) Provide armrest drink holders for front row seating.

PART 3 EXECUTION

3.1 FIELD INSPECTION

A. Verify that areas to receive products are free of impediments interfering with installation. Do not begin work until conditions are satisfactory.

3.2 PREPARATION

A. Supplier shall be responsible for field checking site conditions and dimensions.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions and approved submittal drawings.

B. Mount chairs and standards to the concrete risers with the top of seat backs level and in alignment. Front edge of lowered seat cushion shall be 17-1/2 inches above finished floor or greater. Note that mounting height varies to accommodate the deflection of the precast concrete units.

3.4 FIELD QUALITY CONTROL

A. Field Quality Control tests to be performed by certified testing agency acceptable to authority having jurisdiction.

B. Perform anchor bolt pull-out tests to confirm required capacity at the following locations:

1. Two pull-out tests at existing seating decks.
2. Two pull-out tests at new precast seating units.
3. Two pull-out tests at permanent fixed seating deck system.

C. Test results to be submitted to Architect for review and approval.

3.5 ADJUSTMENT AND CLEANING

A. All equipment to be cleaned and adjusted for smooth and proper operation.

B. Clean work area and remove debris from site on a daily basis.

3.6 MAINTENANCE AND OPERATION:

A. Instructions in both operation and maintenance shall be transmitted to the owner by the manufacturer of the seating or his representative.

B. Maintenance and operation of the seating system shall be the responsibility of the owner or his daily authorized representative.

END OF SECTION 127300

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Bicycle racks.
2. Tree Grates
3. Decorative Bollards

B. Related requirements:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities procedures.
2. Section 312000 “Earth Moving” for excavation for installing concrete footings.
3. Section 033000 “Cast-in-place Concrete” for cast in place concrete piers, footings, foundations, and pedestals.
4. Section 055000 “Metal Fabrications” for metal secondary supports.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Maintenance Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality.

B. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; recommended in writing by manufacturer, for exterior applications.

C. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing

protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

D. Galvanizing:

1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.2 BICYCLE RACKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Stainless Steel Dero Downtown Rack as manufactured by Dero Bike Racks

B. Style: Double -side parking.

Capacity: As specified on site plans.

C. Installation Method: Foot Mount and as detailed

D. Steel Finish: Satin finish

2.3 TREE GRATES

A. Basis-of-Design Product: Subject to compliance with requirements, provide R-8810 Tree Grate w/ Frame as manufactured by Neenah Foundry Company

B. Installation Method: As detailed.

C. Steel Finish: Cast Gray Iron

2.4 DECORATIVE BOLLARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Fairweather model B-1, 8” Dia. Steel bollard,, 36” High, sch 40 pipe.

B. Installation Method: Embed Mounting and as detailed.

C. Steel Finish: Color Coated

1. Color: Black

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated on drawings or within specifications. Complete field assembly of site furnishings where required.

B. Post Setting: Set cast-in support posts in concrete footing plumb or at correct angle and aligned and at correct height and spacing.

END OF SECTION 129300

SECTION 142400 - HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hydraulic passenger and service elevators.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 051200 "Structural Steel Framing" for the following:

    a. Hoist beams.

3. Section 055000 "Metal Fabrications" for the following:

    a. Structural-steel shapes for subsills.
    b. Pit ladders.

4. Section 221429 "Sump Pumps" for sump pumps, sumps, and sump covers in elevator pits.
5. Section 271500 "Communications Horizontal Cabling" for telephone service for elevators.
6. Section 283111 "Digital, Addressable Fire-Alarm System" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

1.3 DEFINITIONS

A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

B. Service Elevator: A passenger elevator that is also used to carry freight.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment.
2. Include large-scale layout of car-control station.
3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch- square Samples of sheet materials; and 4-inch lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For elevator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Furnish well casing and coordinate delivery with related excavation work.

C. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Stanley Elevator Company, Inc.

B. Source Limitations: Obtain elevators from single manufacturer.

1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with Section 407 in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

C. Seismic Performance: Design elevator system to meet the seismic risk zone as determined by the authority having jurisdiction, including building official and elevator inspector.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Elevator Numbers: 01, 03 and 04.
2. Type: Holeless, beside-the-car, telescoping, dual cylinder.
3. Rated Load: 4500 lb.
4. Freight Loading Class for Service Elevators: Class A.
5. Rated Speed: 125 fpm.
6. Operation System: Selective-collective automatic.
7. Auxiliary Operations:

    a. Battery-powered lowering.
    b. Independent service.

8. Security Features: Keyswitch operation for Suite levels.
9. Car Enclosures:

    a. Inside Width: 68 inches from side wall to side wall.
    b. Inside Depth: 94 inches from back wall to front wall (return panels).
    c. Inside Height: 88 inches to underside of ceiling.
    d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Side and Rear Wall Panels: Plastic laminate.
    g. Reveals: Enameled steel.
    h. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    i. Door Sills: Aluminum, mill finish.
    j. Ceiling: Luminous ceiling.
    k. Handrails: 1/2 by 2 inches rectangular satin stainless steel, No. 4 finish, at sides of car.
    l. Floor: Manufacturer's standard carpet.

10. Hoistway Entrances:

    a. Width: 48 inches.
    b. Height: 84 inches.
    c. Type: Two-speed side sliding.
    d. Frames: Enameled steel.
    e. Doors: Enameled steel.

f. Sills: Aluminum, mill finish.

11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
b. Provide hooks for protective pads and one complete set of full-height protective pads.

2.4 SYSTEMS AND COMPONENTS

A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump shall be submersible type with submersible squirrel-cage induction motor, and shall be suspended inside oil tank from vibration isolation mounts or shall be tank-top-mounted type with fan-cooled, squirrel-cage induction motor, and shall be mounted on oil tank with vibration isolation mounts and enclosed in prime-painted steel enclosure lined with 1-inch- thick, glass-fiber insulation board.
2. Motor shall have wye-delta or solid-state starting.
3. Motor shall have variable-voltage, variable-frequency control.

B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.

C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.

1. Cylinder units shall be connected with dielectric couplings.
2. Casing for Underground Piping: Schedule 40 PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.

D. Hydraulic Fluid: Elevator manufacturer's standardfluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

E. Hydraulic Fluid: Nontoxic, biodegradable fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives and approved by elevator manufacturer for use with elevator equipment.

F. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.

G. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1/CSA B44, of sufficient size to provide not less than 1-inch clearance from cylinder and extending above pit floor. Casing shall have means of monitoring effectiveness to comply with ASME A17.1/CSA B44.

H. Corrosion-Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler shall be electrically nonconductive, displace or absorb water, and gel or solidify at temperatures below 60 deg F.

I. Car Frame and Platform: Welded or bolted steel units.

J. Guides: Roller guides; polymer-coated, nonlubricated sliding guides; or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.

B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. Single-Car Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations. Key is removable in either position.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Subfloor: Exterior, underlayment grade plywood, not less than 5/8-inch nominal thickness.
2. Floor Finish: Elevator manufacturer's standard level-loop nylon carpet; color as selected by Architect from manufacturer's full range.
3. Enameled-Steel Wall Panels: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
4. Stainless-Steel Wall Panels: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
5. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch fire-retardant-treated particleboard with plastic-laminate panel backing and manufacturer's standard

protective edge trim. Panels have a flame-spread index of 75 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from elevator manufacturer's full range.

6. Fabricate car with recesses and cutouts for signal equipment.
7. Fabricate car door frame integrally with front wall of car.
8. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
9. Sight Guards: Provide sight guards on car doors.
10. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
11. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
12. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1-1/2 hours.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Enameled-Steel Frames: Formed from cold- or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both inside surfaces of hoistway door frames.
3. Enameled-Steel Doors: Flush, hollow-metal construction; fabricated from cold-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M.

2.9 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life lamps and acrylic or other permanent, non-yellowing translucent plastic diffusers or LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.

2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 283111 "Digital, Addressable Fire-Alarm System"

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing.

1. Provideunits with flat faceplate for mounting with body of unit recessed in wall.
2. Equip units with buttons for calling elevator and for indicating applicable direction of travel.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

1. At manufacturer's option, audible signals may be placed on cars.

I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above hoistway entrance at ground floor. Provide units with flat faceplate for mounting and with body of unit recessed in wall.

1. Integrate ground-floor hall lanterns with hall position indicators.

J. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

K. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

E. Stainless-Steel Bars: ASTM A 276, Type 304.

F. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

G. Aluminum Extrusions: ASTM B 221, Alloy 6063.

H. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications and Type BKV for panel backing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cylinders plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

D. Install piping above the floor, where possible. Install underground piping in casing.

E. Lubricate operating parts of systems as recommended by manufacturers.

F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.

H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

I. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. Place hall lanterns either above or beside each hoistway entrance.
2. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Not permitted.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).

B. Check operation of each elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less.
3. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 142400

SECTION 143100 - ESCALATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes high-traffic, interior escalators.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Section 051200 "Structural Steel Framing" for attachment plates, angle brackets, and other preparation of structural steel to support escalator trusses.
3. Section 083113 "Access Doors and Frames" for wall and ceiling access panels and access doors in escalator enclosures.
4. Section 101400 "Signage" for "Caution" signs required by ASME A17.1/CSA B44.
5. Section 283111 "Digital, Addressable Fire-Alarm System" for smoke detectors that activate escalator alarm and, after at least 15 seconds, cause the interruption of power to the escalator motor and brake and for connection to escalator controllers.

1.3 DEFINITIONS

A. High-Traffic Escalators: Designed specifically for high-traffic-volume use that produces dense occupancy resulting in structural, machinery, and brake loads much higher than normal.

1.4 ACTION SUBMITTALS

A. Product Data: Include capacities, sizes, performances, safety features, finishes, and similar information.

B. Shop Drawings:

1. Include plans, elevations, sections, and details indicating coordination with building structure and relationships with other construction.
2. Indicate maximum loads imposed on building structure at points of support, and power requirements.
3. Indicate access and ventilation for escalator machine space.

C. Samples for Selection: For exposed escalator finishes, 3-inch- square Samples of sheet materials, and 4-inch lengths of running trim members.

D. Delegated-Design Submittal: For escalators.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Certificates: For escalator equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Manufacturer Certificates: Signed by manufacturer certifying that escalator layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for escalator system being provided.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For escalators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted escalator use.

C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Escalator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

A. Coordinate installation of sleeves, block outs, escalator equipment with integral anchors, and other items that are embedded in concrete or masonry for escalator equipment. Furnish templates, sleeves, escalator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

B. Coordinate locations and dimensions of other work relating to escalators including sumps and floor drains in pits; electrical service; and electrical outlets, lights, and switches in pits.

1.10 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace escalator work that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Model 9300AE 10-30-100K by Schindler Elevator Corp. or comparable product by one of the following:

1. Otis Elevator Co.
2. ThyssenKrupp Elevator.

B. Source Limitations: Obtain escalators from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Braking Performance: Provide brakes that produce a stopping force on escalator in up-running mode that is one-third that used in down-running mode.

C. Step/Skirt Performance Index: Not more than 0.15.

D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design escalators.

E. Seismic Performance: Escalators shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Design earthquake spectral response acceleration short period (Sds) for Project is 0.160.

2. Project's Seismic Design Category: A.
3. Escalator Component Importance Factor: 1.0.

F. Structural and Mechanical Performance for High-Traffic Escalators: For the purposes of structural design, driving machine and power transmission calculations, and brake calculations, design high-traffic escalators for loads not less than two times the design loads required by ASME A17.1/CSA B44.

G. Structural Performance of Balustrades, Deck Barricades, and Handrails: Provide components and assemblies capable of withstanding the effects of loads indicated in ASCE/SEI 7 for handrail assemblies and guardrail systems.

2.3 ESCALATORS

A. High-Traffic Escalators, General: Manufacturer's high-traffic escalators complying with requirements. Unless otherwise indicated, manufacturer's heavy-duty components shall be used, as included in standard high-traffic escalator systems and as required for complete system.

B. Design and equip escalators to run in either direction.

C. Provide escalators with two flat steps at top and bottom landings.

D. Rated Speed: 90 fpm.

2.4 COMPONENTS

A. Fabricate exposed metalwork, including deck covers, balustrade panels, and trim to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use; increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as necessary. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

B. Transparent Balustrades: Manufacturer's standard profile or arrangement of moving handrails on guide rail that is supported by tempered glass panels, with deck covers, skirts, trim, and accessories. Prepared for exterior finish below the deck covers; exterior finish specified in another Section.

C. Direction Indicator Lights: Provide red and green indicator lights at least 2 inches in diameter in both balustrade newels at both upper and lower landings. Green light indicates entrance end, and red light indicates exit end. When escalator is stopped, red lights are illuminated at both ends.

D. Guards at Ceiling Intersection: Clear plastic.

E. Handrails: Smooth, jointless, reinforced neoprene.

1. Color: Black.

F. Deck Covers and Trim: Satin stainless steel.

G. Skirt Panels, if Applicable: Satin stainless steel.

H. Skirt Deflector Devices: Manufacturer's standard brush-type device.

I. Steps: One-piece, die-cast aluminum with demarcation grooves at front and rear of tread surface.

1. Finish: Powder-coated, gray.
2. Step Demarcation: 1-1/2- to 2-inch- wide yellow stripe at sides and backs of step treads.
3. Nosing Demarcation: 2-inch- wide yellow stripe at nosings of step treads.

J. Combs: Integrally colored structural plastic.

1. Comb Color: Yellow.

K. Combplate Lights: Provide recessed light fixtures with flush lenses mounted in skirt panels at each side of combplates, designed to illuminate combplate steps.

2.5 FEATURES

A. Operational Control: Provide key-operated starter switches and key-operated switches for directional control located on exterior deck above newel base at both upper and lower landings of escalators.

B. Fault Indicator: Provide escalators with a microprocessor unit that monitors safety devices, motor temperature, and escalator speed and records in nonvolatile memory the date, time, and device identification if a safety device is activated or escalator malfunctions.

1. Provide built-in unit to display recorded information.

C. Reduced-Current Starting: Provide escalator motors with wye-delta or solid-state starting.

D. Provide motors complying with NEMA MG 1, Insulation Class B.

E. Brake-Saving Feature: Provide stopping mechanism that allows escalator to coast to a stop before applying brakes, unless stopping is initiated by a safety device.

F. Equip step drive mechanism with automatic step-chain lubricators.

G. Oil Drip Pan: Provide metal pan under full width and length of escalator to collect and hold oil and grease drippings from lubricated components. Design and fabricate drip pan to sustain a load of 250 lbf on a 1.0-sq. ft. area at any location without permanent deflection.

H. Overspeed Governor: Provide units with overspeed governor that is activated if speed of steps exceeds rated speed by more than 20 percent.

I. Upper-Landing, Step Upthrust Device: Activated if a step is displaced against upthrust track at upper curve in passenger-carrying line of track system.

J. Comb-Step Impact Device: Activated if a horizontal force in direction of travel is applied exceeding 400 lbf at either side or exceeding 800 lbf at center of front edge of combplate, or a resultant force in upward direction is applied exceeding 150 lbf at center of front edge of combplate.

2.6 MATERIALS

A. Stainless Steel: ASTM A 240/A 240M, Type 304.

1. Satin Finish: No. 4 directional satin.

B. Steel Sheet: Cold-rolled steel sheet, ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Clear Tempered Glass: ASTM C 1048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing, select), Kind FT (fully tempered), 12.0 mm thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine escalator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine supporting structure, machine spaces, and pits; verify critical dimensions; and examine conditions under which escalators are to be installed.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions.

B. Set escalators true to line and level, properly supported, and anchored to building structure. Use established benchmarks, lines, and levels to ensure dimensional coordination of the Work.

C. Adjust installed components for smooth, efficient operation, complying with required tolerances and free of hazardous conditions. Lubricate operating parts, including bearings, tracks, chains, guides, and hardware. Test operating devices, equipment, signals, controls, and safety devices. Install oil drip pans and verify that no oil drips outside of pans.

D. Repair damaged finishes so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of escalator installation and before permitting escalator use, perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by authorities having jurisdiction.

1. For escalators specified to comply with requirements more stringent than those of ASME A17.1/CSA B44, perform tests for compliance with specified requirements. Test safety devices that are not required by ASME A17.1/CSA B44 as well as those that are.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain escalators.

B. Check operation of escalators with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.5 MAINTENANCE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of escalator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper escalator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance during normal working hours.
2. Perform emergency callback service during normal working hours with response time of two hours or less. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 143100

DIVISION 21 - FIRE PROTECTION

1. Sprinkler system shall be provided in accordance with NFPA 13, the State Fire Marshal's Office and local AHJ.

2. Sprinkler system shall consist of exterior municipal water service to building. Local hydrant flow test shall be performed and data provided by local Water Department.

    i. Sprinkler system to be designed, furnished, and installed by the Fire Protection Contractor.
    ii. In occupied areas with finished ceilings sprinklers shall be recessed, semi-recessed, or sidewall, with matching escutcheon plates, and concealed piping.
    iii. In occupied areas with exposed structure sprinklers shall be exposed, brass upright, and piping exposed.
    iv. In unoccupied spaces sprinklers shall be exposed and piping exposed.
    v. Sprinkler system shall be tied into Fire Alarm System to indicate alarm or trouble condition.

3. Existing sprinkler water service to remain. ***Offset existing 8" sprinkler main at Fire Pump room to accommodate new structural column.***

4. Existing distribution and sprinklers at Bowl (Ordinary Hazard Group 2) to remain.

5. Existing Fire Department Connection, test, drain to remain. Must remain accessible during construction (existing wall indicated to remain intact).

6. Provide new second Fire Department Connection at new NW entry.

7. Existing Fire pump test report provided, ***existing fire pump to remain in place***.

8. Provide budget line item to replace Fire Pump - Alternate.

9. Provide new Fire Pump Control Panel (remove and replace existing control panel)

10. ***Extend existing system*** to serve new infill area(s).

11. Provide new sprinklers above and below new ***mid and upper suites***.

12. Connect to existing locations and extension of existing sprinkler to new and renovated spaces. ***Refer to DD and CD documents.***

DIVISION 22 - PLUMBING

1. General

   A. Plumbing systems shall be in accordance with the IAPMO 2009 Uniform Plumbing Code as adopted by the State of Maine, ADA, ASHRAE 90.1, and International Building Code.

2. Roof Drainage Systems

   A. Existing roof drain leaders to remain. ***Refer to DD and CD documents.***

   B. Two existing roof drain exists to remain. No new roof drain exits anticipated as site drain and connected associated drainage piping and areas appear similar to new projected roof areas in areas of new construction and infill. Connection to existing points to be determined. Southwest Entry, apparent conflict with existing roof drain exit site piping and new construction. Remove approximately 120’ of 12” underground pipe to existing manhole at Spring Street. Connect and reroute new 12” underground around new South Entry construction and footings to new manhole at Spring Street, approximately 100’. Remove approximately 60’ of 10” underground pipe serving southwest quadrant rain leader (leader to remain). Connect and offset new 10” above slab thru new Southwest Entry. Exact location and path to coordinated and determined.

   C. Rainwater system piping shall be pitched at no less than 1/8”/ft slope (gravity drainage). Rainwater system piping systems shall be standard weight cast-iron or with hub and spigot joints or no-hub-joints. (PVC with solvent welded joints is acceptable only for underslab and concealed areas).

   D. Roof drains shall be provided at all low points in the building structure and roofing system. Roof drains shall have cast iron bodies with cast iron dome strainers.

   E. New infill roof areas shall be provided with Secondary roof drainage piping with independent terminations above grade (locations and quantity to be determined) and labeled with placard.

   F. Segment B storage area roof drain system to remain.

   G. Segment C Basement apparent conflict with new elevator and existing floor drains and existing footing drains. Remove (2) floor drains and associated underslab branch piping and plug/cap. Remove portion of existing underslab footing drain, offset and reconnect.

3. Domestic Water

   A. Remove existing 4" size water service and replace with 6" size to meet new total fixture count and demand. Provide new valves and backflow preventers. Meters to be provided by utility.

   B. Provide new 6" main with 4" looped distribution. ***Refer DD and CD documents.***

C. Provide new risers for each Club Suite.

D. Provide new branches to all new toilet rooms.

E. Provide new branch to new Commissary.

F. Interior domestic water piping shall be Type L copper with lead free soldered fittings or mechanical joints approved for domestic water applications. Piping systems to be provided with required hanging and anchoring devices to support, and allow for expansion and contraction movement. Branches and individual fixtures shall be provided with isolation valves for maintenance and service. CPVC not acceptable in lieu of copper mains. Pex acceptable in walls.

G. Insulation: Piping systems shall be insulated with materials and thickness in accordance with ASHRAE 90.1-2007 requirements.

4. Domestic Hot Water

A. Remove existing 1400gal+/- horizontal storage tank and appurtenances.

B. Provide new storage tanks, preliminary size three 500 gallon vertical arrangement. Small electrical storage type or tankless gas fired point of use for remote areas.

C. 3" main may remain pending review and phasing. ***Refer to DD and CD documents.***

D. Provide new risers for each Club Suite.

E. Provide new branches to all new toilet rooms.

F. Provide new branch to new Commissary.

G. Interior domestic hot water piping shall be Type L copper with lead free soldered fittings or mechanical joints approved for domestic water applications. Piping systems to be provided with required hanging and anchoring devices to support, and allow for expansion and contraction movement. Branches and individual fixtures shall be provided with isolation valves for maintenance and service. PEX acceptable in walls.

H. Insulation: Piping systems shall be insulated with materials and thickness in accordance with ASHRAE 90.1-2007 requirements.

5. Sanitary

A. Existing 12" sanitary exit to remain. Remove approximately 10’ portion at existing loading dock area Phase 1, offset to avoid new structural columns and new footings, reconnect. Field verify location, condition, and invert, and connection to existing manhole at Center Street.

B. Refer to ***DD*** documents for NW Entry sanitary connection to existing.

C. Existing waste pump in basement level to remain (serves only basement Mech room).

D. Floor drains in basement in poor condition, replace bodies and strainers.

E. No existing exterior grease trap, all interior point of use type at existing concessions.

F. Provide new grease trap at ***to serve*** new Commissary, refer to Civil CD documents)

G. Provide new grease trap at each new Concession, above slab point of use type.

H. Provide new waste and vent piping for all new fixtures (connection to existing points to be determined.)

I. Provide new waste and vent risers for each Club Suite.

J. Provide floor drains with trap primers at all toilet rooms.

K. Provide floor sinks at all Concessions (assume qty 2 at each Concession).

L. Provide floor sinks at Commissary (assume qty 6).

M. Sanitary system piping shall be pitched at no less than ¼”/ft slope (gravity drainage). Sanitary drainage, waste, and vent (DWV) piping systems shall be standard weight cast-iron or with hub and spigot joints or no-hub-joints. (PVC with solvent welded joints is acceptable only for underslab and concealed areas).

N. ***Provide oil/sand interceptor in loading area to serve new loading area interior floor drains, recessed floor type, with H-20 cover. Size and location to be determined. Refer to DD documents for approximate location.***

6. Natural Gas

   A. Existing natural gas service and meter is located in area of new work. Service shall remain operational until new service is in place and operational.

   B. Provide new service from Center Street. ***Refer to DD documents.***

   C. Provide gas piping to all new gas fired equipment (Boilers, DWH, food service equipment, RTUs)

   D. Piping shall be sized for 2 psig distribution, dedicated branch for Boiler Rm, dedicated branch for food service, ***dedicated branch to emergency generator***.

   E. Piping shall be Schedule 40 black iron with welded joints. Flanged or threaded joints are acceptable at final connections to equipment.

7. Condensate Drain

   A. Condensate drains shall be provided for all mechanical equipment with cooling coils. Condensate drainage system shall be independently vented, terminate and discharge into the sanitary drainage system within the building via an indirect waste air-gap fitting. Condensate drain pumps shall be provided in locations where gravity drainage is not feasible. Condensate drainage piping system shall be schedule 40 PVC with solvent welded fittings.

8. Fixtures

   A. Remove all existing plumbing fixtures, except in area identified to remain.

   B. All fixtures shall have water conserving valves and controls. All faucets, valves and accessories shall be cast brass construction. All plumbing fixtures shall be A.D.A. compliant where handicap accessibility is required.

      i. Fixture considerations below to be reviewed with owner/operator based on requirements specific areas served.
      ii. Water Closets: Vitreous china, wall hung fixtures, high efficiency toilet, 1.28 GPF ultra low volume flushometer type, siphon jet action, with elongated bowl, open front seat, no cover. Automatic exposed flush valves, with manual push button override.
      iii. Urinals: Waterless type, manufactured by Falcon.
      iv. Lavatories: Wall hung or countertop. Automatic faucets with 0.5 GPM flow restrictors.
      v. Sinks: 18-gauge stainless steel.
      vi. Mop Sinks: Floor mounted, composite material, with wall hung hot and cold faucet with pail-hook, vacuum breaker, hose and mop hangers. Check valves shall be provided on hot and cold water supply to fixture and eyewash/drench hose.

vii. Drinking Fountains: Bi-level, ADA.

viii. Wall Hydrants and Hose Bibbs: Exterior, frost proof, self draining type wall hydrants, with vacuum breaker, removable key control, shall be provided at each building exterior exposure for maintenance use. Interior hose bibs shall be provided in service and mechanical spaces.

DIVISION 23 - MECHANICAL

1. General

A. Equipment Efficiency: Systems shall be designed to meet or exceed energy requirements as required by ASHRAE 90.1 and Efficiency Maine incentive requirements. Systems shall be provided with equipment exceeding the minimum efficiencies and shall provide energy management system as required to provide monitoring and trending of system performance. Mechanical systems equipment, fans, pumps, etc. shall be selected for optimum part-load performance and efficiency. All electric motors driving mechanical equipment shall be premium efficiency rated.

B. Facility shall comply with ASHRAE 62-2007 Standard for Indoor Air Quality. All occupied spaces shall be heated and mechanically ventilated. Units shall be located to minimize noise and allow for ease of maintenance.

C. Non-Structural Seismic Controls: Mechanical and Plumbing components are assumed exempt from the requirements of ASCE 7 Chapter 13 Seismic Design for Nonstructural Components based on assumed Facility Seismic Design Category B.

D. Testing, Adjusting & Balancing: All water and air systems shall be tested, adjusted, and balanced at project completion. All TAB operations shall be coordinated with commissioning agent. TAB work shall be performed by an independent contractor within the contract.

2. Boiler Plant

A. Remove existing gas fired boilers.

B. Provide (3) new condensing gas-fired boilers, each sized for approximately 40% of load, each. Basis of design Lochinvar Crest.

C. Provide new inline primary injection circulator pumps for each boiler.

D. Provide new boiler breeching and stack, refer to ***DD*** Drawings, for preliminary locations and path.

3. Chiller Plant

   A. The Concept report indicated the operational 550t existing chiller will barely meet the current load, and offers no redundancy. One unit is no longer operational, and disconnected from the piping system.

   B. Remove the two (2) existing centrifugal chillers in basement.

   C. Remove existing cooling tower and all condenser water pumps and associated piping.

   D. Remove existing remote sump/basin in basement.

   E. Operator requested review of an air-cooled system, far less maintenance, and less first cost, minimal run time noted of approximately 70 hrs/yr.

   F. Provide two (2) new nominal 300t air-cooled screw chillers. Basis of Design: Trane RTAC with VFD. Proposed location indicated on Loading Dock roof. Coordinate clearances and layout.

4. Hydronic Piping Systems

   A. Remove existing abandoned piping in basement.

   B. Existing 10” risers to remain.

   C. Remove existing ***abandoned brine condenser water heat recovery*** plate and frame HX. ~~currently used for heating and cooling changeover. (Unit may remain, pending condition and capacity, and or plates added/replaced).~~

   D. Remove two (2) existing horizontal split-case hydronic HW/CW distribution pumps. Capacity to be reviewed, one of three pumps has been previously removed.

   E. Provide three (3) new pumps, preliminary size 40hp each, matching type and in existing locations. Loads and redundancy to be reviewed further.

   F. Piping 2" and smaller: Schedule 40 steel piping with threaded joints; or Type L copper tubing with mechanical joints or soldered joints.
   G. Piping 2-1/2" and larger: Schedule 40 steel piping with grooved mechanical joints, flanged joints, or welded joints.

H. Insulation: Piping systems shall be insulated with materials and thickness in accordance with ASHRAE 90.1-2007 requirements.

5. Ice Sheet System

A. Test and balance existing system, submit results for baseline prior to removal of any components.

B. Existing distribution piping and under slab ice sheet piping to remain.

C. Remove two (2) abandoned water-cooled Brine Chillers, and associated abandoned condenser water pumps and piping located in basement.

D. Remove and relocate two (2) existing 2 Carrier air-cooled chillers. Proposed location indicated on Loading Dock roof. Coordinate clearances and layout.

E. New Brine piping to CTE point in existing basement. ***Refer to DD documents.***

F. Existing Brine pumps to remain.

G. Brine tank located in an area of demo, ***remain, remove or new in basement*** ~~relocate~~ to be determined. ***Review in progress.***

H. Existing controls intended to remain (to be reviewed further and verified).

I. Existing Zamboni pit and components to remain. ***Provide new insulation and PVC jacket on portions of damaged existing pipe insulation.***

6. Air Systems

A. Test and balance all bowl air systems, submit results for baseline prior to removal of any components.

B. Replace four (4) existing 40k CFM units at fan rooms/mezzanines, match existing configuration, based on Trane. Existing exterior louvers to remain.

C. Remove/replace units via roof.

D. Maintain existing ductwork serving bowl.

E. Provide (2) new destratification fans for bowl.

F. Existing dehumidification unit remain. ***Remove existing dehumidification unit from fan room roof to accommodate replacement of indoor air handler. Reinstall existing dehumidification unit back to roof of fan room.***

G. Remove ducts and systems serving areas to be renovated (outside of the Bowl area)

H. Provide new RTU for NW Lobby, offices, meeting spaces; DX cooling (separate from central cooling system), gas heat, and VAV bypass zones. ***Refer to CD documents.***

I. Provide new 25 ton RTU for SE corner Lobby, DX (separate from central cooling system), gas heat, and VAV bypass zones.

J. Provide dedicated roof mounted exhaust fans for new toilet areas, zone to minimize ductwork, by quad/segment.

K. Locker Rooms:

   i. Provide new dedicated home team locker room ventilation system~~s~~, with 100% OA VAV RTU, DX cooling, indirect, natural gas heat, dehumidification, energy recovery and VAV boxes with HW reheat coils for additional comfort control.

   ii. Provide new dedicated visitor locker room ventilation system with 100% OA ERU with energy recovery core and hot water heating coil.

L. Club at Concourse – conditioned space is required. Provide a dedicated RTU, approximately 5ton capacity.

H. Flex 1 and 2 (132 & 133) at event level – conditioned space is required. Provide a dedicated ~~RTU~~ ***variable refrigerant volume (VRF) system***, approximately 3ton capacity. ***Refer to DD documents.***

I. Ice Suites 1 & 2 (156 & 158) at event level – conditioned space is required. Provide a dedicated RTU ***variable refrigerant volume (VRF) system***, approximately 2ton capacity. ***Refer to DD documents.***

M. Provide new systems for new Commissary; NFPA 96 ventilation systems (2 hoods) for cooking line up and dishwashing . Provide mechanical make-up air system with gas heat. Exhaust hoods provided by food equipment service vendor.

N. Provide new systems for Concessions; NFPA 96 ventilation systems, makeup air from concourse/bowl (4 locations with hoods and gas). Refer to preliminary Food Service drawings.

O. Maintain return air slots at the seats.

P. Provide new mechanical ventilation system for basement mechanical room; combustion air, exhaust air.

Q. Provide new mechanical ventilation systems for new Main Switchgear and new Emergency Electrical Rooms.

R. Provide new mechanical ventilation systems for each new Elevator Machine Room.

S. Existing General Exhaust Fans; (2) ~53k CFM, 10hp, roof mounted fans, make-up is via loading doors cracked open. It's NOT an engineered Smoke Control or a Smoke Evacuation system NOT automated and NOT connected to FA system. Existing fans are not UL Listed for Smoke Control and shall be removed. Existing roof openings will be utilized for new Bowl smoke control fans.

T. Provide new Engineered Smoke Control System; Refer to DD documents, drawing M8.01 for preliminary locations and associated airflows. Based on calculations and model provided by FP&C Consultants dated 8.17.2012, Bowl 150,000 CFM, Concourse 120,000 CFM, West Lobby and Stair 60,000 CFM exhaust required.

U. Elevator Hoistway Venting: Provide gravity vent with motorized damper at top of each elevator shaft.

V. Air Intakes: Louvers shall be provided for system air intakes, located coordinated to maintain clearances to exhausts, plumbing vents and parking areas.

W. Air Distribution: Ductwork shall be galvanized steel construction and be fabricated and installed per SMACNA standards. Ductwork layout shall be as direct as possible, coordinated chases to minimize length, pressure drop restrictions, elbows and offsets.

X. Insulation: Duct systems shall be insulated with materials and thickness in accordance with ASHRAE 90.1-2007 requirements.

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. SUMMARY

C. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Sleeves.
3. Escutcheons.
4. Supports and anchorages.

D. Related Sections:

1. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.
2. Division 21Section “Vibration and Seismic Controls for Fire-Suppression Piping and Equipment”.
3. Division 21 Section "Electric Drive Centrifugal Fire Pumps” for fire pumps.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.5 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

2.2 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

K. Sleeves are not required for core-drilled holes.

L. Install sleeves for pipes passing through concrete and masonry walls and concrete floors.

M. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting"

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.5 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION 210500

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. ASCE: American Society of Civil Engineers.

1.3 PERFORMANCE REQUIREMENTS

A. Design Criteria:

1. Fire Suppression Piping and Equipment components are exempt from the requirements of ASCE 7 Chapter 13 Seismic Design for Nonstructural Components.

2. Refer to Structural General Notes Sheet S0.01.

3. Building Occupancy Category: III

4. Site Class: B

5. Seismic Design Category: A

1.4 SUBMITTALS

A. None.

PART 2 - PRODUCTS

2.1 None

PART 3 - EXECUTION

3.1 None.

END OF SECTION 210548

SECTION 211200 - FIRE-SUPPRESSION STANDPIPES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Hose connections.
4. Fire-department connections.
5. Alarm devices.
6. Manual control stations.

B. Related Sections:
1. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

1.3 DEFINITIONS

A. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Refer to Drawings for existing systems to remain, removals, proposed connections to existing and extensions of systems scope of work in renovated and new areas of construction, and Phasing.

B. Manual Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has small water supply to maintain water in standpipes. Piping is wet, but water must be pumped into standpipes to satisfy demand.

1.5 PERFORMANCE REQUIREMENTS

A. Basis of Design: 65 psig at top of standpipe.

B. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. Sprinkler system design shall be approved by authorities having jurisdiction.

E. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire-suppression standpipes. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

C. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Fire-hydrant flow test report.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

F. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, "Installation of Standpipe and Hose Systems."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Standard-Weight, Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, seamless steel pipe with threaded ends.

C. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.

D. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Cast-Iron Flanges: ASME B16.1, Class 125.

G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

H. Grooved-Joint, Steel-Pipe Appurtenances:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anvil International, Inc.
      b. Corcoran Piping System Co.
      c. National Fittings, Inc.
      d. Shurjoint Piping Products.
      e. Tyco Fire & Building Products LP.
      f. Victaulic Company.
   2. Pressure Rating: 175 psig minimum.
   3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
   4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
   1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
   2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:
   1. Valves shall be UL listed or FM approved.
   2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Check Valves:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. AFAC Inc.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Fire Protection Products, Inc.
      d. Globe Fire Sprinkler Corporation.
      e. Metraflex, Inc.
      f. Milwaukee Valve Company.
      g. Mueller Co.; Water Products Division.
      h. NIBCO INC.
      i. Shurjoint Piping Products.
      j. Tyco Fire & Building Products LP.
      k. Victaulic Company.
      l. Viking Corporation.
   2. Standard: UL 312.
   3. Pressure Rating: 250 psig minimum.
   4. Type: Swing check.
   5. Body Material: Cast iron.
   6. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:
   1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   2. Pressure Rating: 175 psig minimum.

2.6 SPECIALTY VALVES

A. General Requirements:
   1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   2. Pressure Rating:
      a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
   3. Body Material: Cast or ductile iron.
   4. Size: Same as connected piping.
   5. End Connections: Flanged or grooved.

2.7 HOSE CONNECTIONS

A. Nonadjustable-Valve Hose Connections:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. AFAC Inc.
      b. Elkhart Brass Mfg. Company, Inc.

c. Fire Protection Products, Inc.
d. Guardian Fire Equipment, Inc.
e. Kennedy Valve; a division of McWane, Inc.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Tyco Fire & Building Products LP.

2. Standard: UL 668 hose valve for connecting fire hose.
3. Pressure Rating: 300 psig minimum.
4. Material: Brass or bronze.
5. Size: NPS 2-1/2 w/ NPS 1-1/2 reducer
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
8. Pattern: Angle.
9. Finish: Polished chrome plated.

2.8 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. Guardian Fire Equipment, Inc.
d. Tyco Fire & Building Products LP.
2. Standard: UL 405.
3. Type: Exposed, projecting, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, wall type.
9. Outlet: Back, with pipe threads.
10. Number of Inlets: 1 - 4” Storz.
11. Escutcheon Plate Marking: Similar to " STANDPIPE."
12. Finish: Rough brass or bronze.
13. Outlet Size: NPS 4.

2.9 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.

C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.

2.10 SLEEVES

A. Cast-Iron Wall-Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with set-screws.

2.11 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Advance Products & Systems, Inc.
   2. Calpico, Inc.
   3. Metraflex, Inc.
   4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Stainless steel.
   3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.

C. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install drain valves on standpipes. Extend drain piping to outside of building.

E. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.

F. Install alarm devices in piping systems.

G. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.

H. Install pressure gages on riser or feed main and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

I. Fill wet-type standpipe system piping with water.

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

3.6 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device.

3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.

3.9 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes.

C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

D. Install sleeves in new partitions, slabs, and walls as they are built.

E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

G. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.

H. Seal space outside of sleeves in concrete slabs and walls with grout.

I. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

J. Install sleeve materials according to the following applications:
   1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
   2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
      a. Extend sleeves 2 inches above finished floor level.
      b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
   3. Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
   4. Sleeves for Piping Passing through Exterior Concrete Walls:
      a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
      b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
   5. Sleeves for Piping Passing through Interior Concrete Walls:
      a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.

K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.10 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.13 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Standard-pressure, wet-type, fire-suppression standpipe piping, NPS 4 and smaller, shall be one of the following:
   1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

END OF SECTION 211200

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Sections:

1. Division 21 Section "Common Work results for Fire Suppression".
2. Division 21 Section "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment".
3. Division 21 Section "Electric-Drive, Centrifugal Fire Pumps" for fire pumps, pressure-maintenance pumps, and fire-pump controllers.
4. Division 28 Section "Digital, Addressable Fire-Alarm System" for alarm devices not specified in this Section.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Refer to Drawings for existing systems to remain, removals, proposed connections to existing and extensions of systems scope of work in renovated and new areas of construction, and Phasing.

B. Suppression System Water Supply: Existing Public Water Supply.

C. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Hydrant Flow Test Data: Perform hydrant flow test and base calculations on test data.
   a. Coordinate with Portland Water District.

2. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping and valves.

3. Sprinkler Occupancy Hazard Classifications:

   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   e. Office Areas: Light Hazard.
   f. Arena: Ordinary Hazard, Group 2.
   g. Convention Center: Ordinary Hazard, Group 2.

4. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft.area.

5. Exterior Canopies and Overhangs: (Non-Combustible, sprinkler coverage not required.)

6. Maximum Protection Area per Sprinkler: Per UL listing.

7. Maximum Protection Area per Sprinkler: Per NFPA 13.

8. Total Combined Hose-Stream Demand Requirement: Per NFPA 13.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. State of Maine, Fire Marshal’s permit of approval.

E. Welding certificates.

F. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on the requirements of NFPA 13, NFPA 20, and State of Maine Fire Marshal's Office.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified NICET Level III or State of Maine Licensed Professional Engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

1.8 COORDINATION

A. Existing sprinkler service to remain.

B. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including but not limited to light fixtures, HVAC equipment terminal and devices, plumbing equipment, and fixed and moveable partition wall assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.

B. Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

E. Uncoated, Steel Couplings: ASTM A 865, threaded.

F. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

K. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Anvil International, Inc.
    b. Corcoran Piping System Co.
    c. National Fittings, Inc.
    d. Shurjoint Piping Products.
    e. Tyco Fire & Building Products LP.
    f. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.

b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Global Safety Products, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Shurjoint Piping Products.
h. Tyco Fire & Building Products LP.
i. Victaulic Company.
j. Watts Water Technologies, Inc.

C. Ball Valves:

1. Standard: UL 1091 except with ball instead of disc.
2. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
3. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
4. Valves NPS 3: Ductile-iron body with grooved ends.

D. Bronze Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig.
3. Body Material: Bronze.
4. End Connections: Threaded.

E. Iron Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig.

3. Body Material: Cast or ductile iron.
4. Style: Lug or wafer.
5. End Connections: Grooved.

F. Check Valves:

1. Standard: UL 312.
2. Pressure Rating: 250 psig minimum.
3. Type: Swing check.
4. Body Material: Cast iron.
5. End Connections: Flanged or grooved.

G. Bronze OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 175 psig.
3. Body Material: Bronze.
4. End Connections: Threaded.

H. Iron OS&Y Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast or ductile iron.
4. End Connections: Flanged or grooved.

I. Indicating-Type Butterfly Valves:

1. Standard: UL 1091.
2. Pressure Rating: 175 psig minimum.
3. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bronze.
c. End Connections: Threaded.

4. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

5. Valve Operation: Integral electrical, 115-V ac, prewired, two-circuit, supervisory switch visual indicating device.

J. NRS Gate Valves:

1. Standard: UL 262.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Cast iron with indicator post flange.
4. Stem: Nonrising.
5. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fire Protection Products, Inc.
b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Conbraco Industries, Inc.; Apollo Valves.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Potter Roemer.
e. Red-White Valve Corporation.
f. Tyco Fire & Building Products LP.
g. Victaulic Company.
h. Watts Water Technologies, Inc.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fire Protection Products, Inc.
b. United Brass Works, Inc.

E. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AFAC Inc.
b. Globe Fire Sprinkler Corporation.
c. Reliable Automatic Sprinkler Co., Inc.
d. Tyco Fire & Building Products LP.
e. Venus Fire Protection Ltd.
f. Victaulic Company.
g. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Standard: UL 1726.
2. Pressure Rating: 175 psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. GMR International Equipment Corporation.
d. Guardian Fire Equipment, Inc.
e. Potter Roemer.

2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.

6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Escutcheon Plate Marking: Similar to " AUTO SPKR."
12. Finish: Rough brass or bronze.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Standard: UL 213.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-T and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Standard: UL 199.
2. Pressure Rating: 175 psig.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Standard: UL 1474.
2. Pressure Rating: 250 psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175 psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.
7. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Extended-coverage sprinklers.
3. Pendent sprinklers.
4. Pendent, dry-type sprinklers.
5. Quick-response sprinklers.
6. Recessed sprinklers, including escutcheon.
7. Upright sprinklers.

E. Sprinkler Finishes:

1. Brass.
2. Bronze.
3. Painted.

F. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

G. Sprinkler Escutcheons: Materials, types, and finishes for sprinklers head escutcheons are specified with sprinklers.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicators:

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

C. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Kennedy Valve; a division of McWane, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

2.11 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0 to 250 psig minimum.

D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

2.12 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with set-screws.

C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw or spring clips.

E. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated or rough-brass finish with concealed hinge and set-screw.

F. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed hinge, set-screw or spring clips.

G. One-Piece Floor Plates: Cast-iron flange.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.13 SLEEVES

A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

1. Underdeck Clamp: Clamping ring with set-screws.

2.14 SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to Division 31 Earthwork, for excavating, trenching, and backfilling.

B. Refer to Division 31 Earthwork, for exterior piping and accessories.

3.2 WATER-SUPPLY CONNECTIONS

A. Existing sprinkler service to remain.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Fill sprinkler system piping with water.

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.8 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.

B. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish stamped steel with set-screw or spring clips.
3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish.
4. Bare Piping in Unfinished Service Spaces: One piece, stamped steel with set-screw or spring clips.
5. Bare Piping in Equipment Rooms: One piece, stamped steel with set-screw or spring clips.
6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.9 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.

B. Sleeves are not required for core-drilled holes, except in Mechanical Mezzanines.

C. Cut sleeves to length for mounting flush with both surfaces, except in Mechanical Mezzanines..

D. Install sleeves in new partitions, slabs, and walls as they are built.

E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

G. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.

H. Seal space outside of sleeves in concrete slabs and walls with grout.

I. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

J. Install sleeve materials according to the following applications:

1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.

    a. Extend sleeves 2 inches above finished floor level.

3. Sleeves for Piping Passing through Gypsum-Board Partitions:

    a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
    b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
    c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.

4. Sleeves for Piping Passing through Exterior Concrete Walls:

    a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
    b. Cast-iron wall-pipe sleeves for pipes NPS 6 and larger.
    c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."

3.10 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.11 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run excess-pressure pumps.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.14 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.15 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control vales, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.16 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Recessed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Pendent, dry sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Interior Exposed Piping: Plain brass finished sprinkler heads.
2. Recessed Sprinklers (SAT & GWB Ceilings): White finished sprinkler heads and escutcheons.
3. Recessed Sprinklers (Wood Slat Ceilings): Rough brass finished sprinkler heads and escutcheons.

END OF SECTION 211313

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS

A. Division 1 Section 019113 “General Commissioning Requirements”.

1.3 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Escutcheons.
6. Equipment installation requirements common to equipment sections.
7. Supports and anchorages.

1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:
1. PVC: Polyvinyl chloride plastic.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Escutcheons.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.6 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, and chrome-plated finish.

2.8 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION 220500

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.

B. Related Sections:

1. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

C. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ashcroft.
2. Trerice, H. O. Co.

3. Weiss Instruments, Inc.

B. Case: Die-cast aluminum or brass, 9 inches long.

C. Tube: Red or blue reading, organic-liquid filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.

H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.2 BIMETALLIC-ACTUATED DIAL THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.

B. Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.

C. Element: Bimetal coil.

D. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Pointer: Red or other dark-color metal.

F. Window: Glass.

G. Ring: Stainless steel.

H. Connector: Adjustable angle type.

I. Stem: Metal, for thermowell installation and of length to suit installation.

J. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

K. Case: Dry type, stainless steel with 3-inch diameter.

2.3 THERMOWELLS

A. Manufacturers: Same as manufacturer of thermometer being used.

B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Trerice, H. O. Co.
3. Weiss Instruments, Inc.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, drawn steel or cast aluminum, 3-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass.
8. Ring: Metal.
9. Accuracy: Grade B, plus or minus 2 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

B. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

C. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for water service at 20 to 200 deg F shall be CR.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install liquid-in-glass or bimetallic-actuated dial thermometers in locations as indicated on the drawings and details.

B. Install liquid-in-glass or bimetallic-actuated dial thermometers in the outlet of each domestic, hot-water storage tank.

C. Install bimetallic-actuated dial thermometers at suction and discharge of each pump.

D. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages in locations as indicated on the drawings and details.

B. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

C. Install dry-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees where thermometers are indicated.

B. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

C. Install needle-valve and snubber fitting in piping for each pressure gage.

D. Install test plugs in tees in piping.

E. Install permanent indicators on walls or brackets in accessible and readable positions.

F. Install connection fittings for attachment to portable indicators in accessible locations.

G. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

H. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-duty valves:
   1. Copper-alloy ball valves.
   2. Bronze check valves.
   3. Bronze gate valves.

B. Related Sections include the following:

   1. Division 21 fire-suppression piping Sections for fire-protection valves.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.
   3. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

   1. CWP: Cold working pressure.
   2. PTFE: Polytetrafluoroethylene plastic.
   3. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads.
3. Set gate valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following.

a. Conbraco Industries, Inc.; Apollo Div.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corp.
i. Watts Industries, Inc.; Water Products Div.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

E. Valve Actuators:
1. Handwheel: For valves other than quarter-turn types.
2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.

F. Extended Valve Stems: On insulated valves.

G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

A. Copper-Alloy Ball Valves, General: MSS SP-110.

B. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

2.4 BRONZE CHECK VALVES

A. Bronze Check Valves, General: MSS SP-80.

B. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.5 BRONZE GATE VALVES

A. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

B. Type 1, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

2.6 IRON GATE VALVES

A. Class 125, OS&Y, Iron Gate Valves:

1. Standard: MSS SP-70, Type I.
2. CWP Rating: 200 psig.
3. Body Material: ASTM A 126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or gate valves.
2. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

C. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 to NPS 6: Two-piece, 600-psig CWP rating, copper alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125, bronze.
4. Gate Valves, NPS 2 and Smaller: Type 1, Class 125, bronze.
5. Gate Valves, NPS 4 and Larger: Type 1, Class 125, Iron, OS&Y.

D. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends.
2. For Copper Tubing, NPS 2-1/2 and Larger: Flanged ends.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

3.4 JOINT CONSTRUCTION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Carpenter & Paterson, Inc.
3. Grinnell Corp.
4. National Pipe Hanger Corporation.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Thomas & Betts Corporation.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.
2. PHS Industries, Inc.
3. Pipe Shields, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Hilti, Inc.
c. ITW Ramset/Red Head.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. C-Clamps (MSS Type 23): For structural shapes.
2. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.

3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

M. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. General: Any hanger load exceeding 40 lbs shall be suspended from the primary structural steel framing or the contractor shall add supplemental framing (such as Unistrut) between the primary framing.

B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation hangers.

1.3 DEFINITIONS

A. ASCE: American Society of Civil Engineers.

1.4 PERFORMANCE REQUIREMENTS

A. Design Criteria:

1. Plumbing Piping and Equipment components are exempt from the requirements of ASCE 7 Chapter 13 Seismic Design for Nonstructural Components.

2. Refer to Structural General Notes Sheet S0.01.

3. Building Occupancy Category: III

4. Site Class: B

5. Seismic Design Category: A

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
2. Kinetics Noise Control.
3. Mason Industries.

B. Isolation Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern, and factory cut to sizes that match requirements of supported equipment.

1. Basis of Design: Mason Industries Super W Pads

2. Resilient Material: Oil- and water-resistant neoprene.

C. Spring and Neoprene Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Basis of Design: Mason Industries 30N

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7.
8. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

9. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
10. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION-CONTROL DEVICE INSTALLATION

PART 4 - A. General: Vibration control devices for equipment and distribution systems shall be installed in strict accordance with the requirements of approved Submittals.

4.1 FIELD QUALITY CONTROL

A. Vibration Isolator Testing: Perform the following field quality control testing:
1. Isolator deflection.
2. Isolator minimum clearances.

4.2 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

4.3 PLUMBING VIBRATION-CONTROL DEVICE SCHEDULE

A. Domestic Water Pumps:
1. Isolators: Spring and Elastomeric Hangers, 1” deflection.

B. Piping within 100 ft of Domestic Water Pumps
1. Isolators: Spring and Elastomeric Hangers, 1” deflection.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.
   3. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.5 CEILING DOT INSTALLATION

A. Provide ceiling dots on ceiling grid locating concealed plumbing equipment above finished ceilings. Coordinate color scheme with Owner.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Adhesives.
3. Factory-applied jackets.
4. Field-applied jackets.

B. Related Sections include the following:
1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets both factory and field applied.

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000.
   c. Manson Insulation Inc.; Alley-K.
   d. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

2.3 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.4 FIELD-APPLIED JACKETS

A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. Proto PVC Corporation; LoSmoke.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

C. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water (potable and non-potable make-up water):

1. NPS 1 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Tempered Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Roof Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.9 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed: PVC: 20 mils thick, white.

1. All Food Service and Concession areas with exposed insulated piping at final connections to equipment.

2. All Public Spaces with exposed insulated piping risers (to a point from finish floor up to 7’ above finish floor).

END OF SECTION 220700

SECTION 221113 – FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes all work to distribute water including but not limited to the following:

1. New domestic water service

B. Related sections:

1. See other related Division 22 sections for additional requirements governing water service connections within the building.
2. Division 31 Section "Earth Moving for Utilities" for soil materials, excavating, backfilling.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI B16.1	2005 Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.18	2001 Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.22	2001 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ANSI B16.26	2006 Cast Copper Alloy Fittings for Flared Copper Tubes
ANSI B18.2.2	1987 Square and Hex Nuts
ANSI B18.5	2008 Round Head Bolts (Inch Series)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A47	1999 Ferritic Malleable Iron Castings
ASTM A48	2008 Gray Iron Castings
ASTM A307	2002 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

ASTM A536	1984 (Rev 1999) Ductile Iron Castings
ASTM A563	2007 Carbon and Alloy Steel Nuts
ASTM B32	2008 Solder Metal
ASTM B61	2008 Steam or Valve Bronze Castings
ASTM B62	2002 Composition Bronze or Ounce Metal Castings
ASTM B88	2003 Seamless Copper Water Tube
ASTM C94	2009 Ready-Mixed Concrete

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	2008 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water (ANSI/AWWA C104/A21.4)
AWWA C105/A21.5	2005 Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	2008 Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in.
AWWA C111/A21.11	2006 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	2005 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	2002 Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C153/A21.53	2006 Ductile Iron Compact Fittings for Water Service
AWWA C500	2002 Gate Valves for Water and Sewage Systems
AWWA C502	2005 Dry-Barrel Fire Hydrants
AWWA C503	2005 Wet-Barrel Fire Hydrants
AWWA C509	2001 Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	2005 Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C651	2005 Disinfecting Water Mains
AWWA C800	2005 Underground Service Line Valves and Fittings

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	2003 Bronze Gate, Globe, Angle and Check Valves

UNDERWRITERS LABORATORIES, INC. (UL)

UL 246	1993 Hydrants for Fire-Protection Service

UL 262 2004 Gate Valves for Fire Protection Service

1.4 PROJECT CONDITIONS

A. Water Main Work: Work under Section 221113 shall include the following:

1. Installation of water main starting at the connection to the existing main or other supply main and continuing up to the end location as indicated on the Drawings. Work shall also include all piping, fittings, valves, concrete thrust blocks with restraining rods from elbow, all as indicated. Work also to include all flushing and testing.
2. Earthwork for the water main work shall follow Section 312100. Where appropriate, provide final grading and loam, seed, and paving as indicated or to match existing features and restore surfaces to original conditions.

B. Water Service: Work under Section 221113 shall include the following:

1. Installation of water main and water service line starting at the street main or other supply line, continuing up to the end location as indicated otherwise on Drawings. Work shall include all piping, fittings, valves, thrust blocks indicated. Work shall include flushing and testing.
2. Exterior water line work shall follow Section 312100. Where appropriate provide final grading and loam seed and paving as indicated or to match existing features and restore surfaces to original conditions.

C. Location: The work covered by this section shall terminate at a point approximately 10 feet from the building, unless otherwise indicated on the drawings.

D. The General Contractor shall be responsible for all fees and permits related to the connection to the existing municipal water main system.

1.5 DESIGN REQUIREMENTS

A. Water Distribution Mains: Provide water distribution mains of ductile-iron pipe. Provide gate valves where indicated. Provide water main accessories as indicated.

B. Water Service Lines: Provide water service lines from water distribution main to building. Water service lines shall be ductile iron pipe. Provide water service line appurtenances where specified and where indicated. All work shall conform to Portland Water District specifications.

1.6 SUBMITTALS

A. Submit the following in accordance with Section 013300, "Submittals."

B. Manufacturer's Catalog Data:

1. Pipe and fittings
2. Joints and couplings
3. Valves
4. Corporation stops
5. Valve boxes
6. Brass Wedges

C. Submit manufacturer's standard drawings or catalog cuts for the listed items, except submit both drawings and cuts for push-on joints. Include information concerning gaskets with submittal for joints and couplings

D. Manufacturer's Instructions

1. Installation procedures for water piping

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store jointing materials, and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

B. Handling: Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry, do not drag pipe to the trench. Store rubber gaskets and jointing materials that are not to be installed immediately, under cover out of direct sunlight.

PART 2 - PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

A. Piping Materials:

1. Ductile-iron Piping

a. Pipe and Fittings: Pipe shall conform to AWWA C151/A21.51 and shall be Thickness Class 52. Flanged pipe shall conform to AWWA C115/A21.15. Fittings shall conform to AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining conforming to AWWA C104/A21.4, double thickness; pipe and fittings to be bituminous coated per AWWA C104/A21.4.

b. Joints and Jointing Material

1) Joints: Joints for pipe and fittings shall be push-on joints.
2) Push-on Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly shall conform to AWWA C111/A21.11.
3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA C111/A21.11.
4) Flanged Joints: Bolts, nuts, and gaskets for flanged connections shall be as recommended in the Appendix to AWWA C115/A21.15. Flange for setscrewed flanges shall be of ductile iron, ASTM A536, Grade 65-45-12, and shall conform to the applicable requirements of ANSI B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated and zinc-coated steel.

Gasket for setscrewed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made.

2. PE PIPE AND FITTINGS

a. PE, ASTM Pipe: ASTM D 2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 200 psig.
   1) Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
   2) Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

b. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 200 psig.
   1) PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.

c. Acceptable products/manufacturers:
   1) Ipex Inc.
   2) Or approved similar/equal

B. Valves and Other Water Main Accessories

1. Gate Valves on Buried Piping: AWWA C500, to AWWA C509, or to UL 262. Unless otherwise specified, valves conforming to AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint ends for the adjoining pipe. Unless specified otherwise, valves conforming to AWWA C509 shall be nonrising stem type with mechanical-joint ends. Unless otherwise specified, valves conforming to UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends or push-on joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by right rotation of the valve stem. Stuffing boxes shall have 0-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall be of one manufacturer. Acceptable product/manufacturers are:

   a. Mueller A2360
   b. Approved Equal

2. Valve Boxes: Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast-iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 ¼ inches. Each cast-iron box shall have a heavy coat of bituminous paint.
3. Sleeve-type Mechanical Couplings: Design to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. Middle ring shall be of cast-iron and the follower rings shall be of malleable iron or ductile iron. Cast iron shall conform to ASTM A48 and shall be not less than Class 25. Malleable iron shall conform to ASTM A47. Ductile iron shall conform to ASTM A536. Gaskets shall be designed for resistance to set after installation and shall meet the applicable

requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Bolts shall be track-head type; bolts and nuts shall be either of the following: bolts conforming to tensile requirements of ASTM A307, Grade A, with nuts conforming to tensile requirements of ASTM A563, Grade A; or round-head square-neck type bolts conforming to ANSI B18.5 with hex nuts conforming to ANSI B18.2.2. Bolts shall be 5/8-inch in diameter; minimum number of bolts for each coupling shall be as required for the application. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint

2.2 WATER SERVICE LINE MATERIALS

A. Piping Materials

1. Copper Tubing and Associated Fittings: Tubing shall conform to ASTM B88, Type K. Fittings for solder-type joint shall conform to ANSI B16.18 or ANSI B16.22; fittings for compression-type joint shall conform to ANSI B16.26, flared tube type. All brass fittings to be lead free.

2. PE PIPE AND FITTINGS

a. PE, ASTM Pipe: ASTM D 2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 200 psig.
   1) Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
   2) Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

b. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 200 psig.
   1) PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.

B. Water Service Line Appurtenances

1. Corporation Stops: Ground key type; made of bronze conforming to ASTM B61 or ASTM B62; and suitable for the working pressure of the system. Ends shall be suitable for solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing shall conform to ANSI B16.26.
2. Goosenecks: Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Length of goosenecks shall be in accordance with standard practice.
3. Curb or Service Stops: Ground key, round way, inverted key type; shall be made of bronze conforming to ASTM B61 or ASTM B62; and suitable for the working pressure of the system. Ends shall be as appropriate for connection to the service piping. Arrow shall be cast into body of the curb or service stop indicating direction of flow.
4. Gate Valves Smaller Than 3-inch Size on Buried Piping: MSS SP80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.
5. Curb Boxes: Provide for each curb or service stop. Curb boxes shall be of cast-iron of a size suitable for the stop on which it is to be used. Provide a round head with the word "WATER" cast on the lid. Each box shall have a heavy coat of bituminous paint.

6. Valve Boxes: Provide for each gate valve on buried piping. Valve boxes shall be of cast-iron of a size suitable for the valve on which it is to be used and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Each cast-iron box shall have a heavy coat of bituminous paint.
7. All brass components shall be lead-free.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPELINES

A. General Requirements for Installation of Pipelines: These requirements shall apply to pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

1. Location of Water Lines: The work covered by this section shall terminate at points as described in Part 1 of this Section and as indicated. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line. Where water lines cross under gravity sewer lines, encase sewer line fully in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing. Lay water lines which cross sewer force mains at least 2 feet above these sewer lines; when joints in the sewer line are closer than 3 feet horizontally from the water line, encase these joints in concrete. Do not lay water lines in the same trench with gas lines, fuel lines or electric wiring.
2. Earthwork: Perform earthwork operations in accordance with Section 312100.
3. Pipe Laying and Jointing: Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade, and secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevents installation. Install three (3) brass wedges at each bell prior to backfill.
4. Installation of Tracer Wire: Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
5. Connections to Existing Lines: Contractor shall obtain and pay for fees and permits which may be required to connect to existing lines. After approval is obtained, make connections to existing water lines with a minimum interruption of service on the existing line. Make connections in accordance with the recommended procedures of the manufacturer of pipe of which the line being tapped is made. Contact the local utility company before making connections to the existing line. Follow criteria and regulations of the local utility when making connections to existing line.

B. Installation of Water Mains:

1. Special Requirements for Ductile-iron Piping Installation

a. Installation, General: Unless otherwise specified in the following subparagraphs, install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

b. Jointing:

1) Make push-on joints with the gaskets and lubricant previously specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.

2) Make mechanical-joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of Appendix A to AWWA C111/A21.11.

3) Make flanged joints with the gaskets, bolts, and nuts previously specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, and valves. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When any flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use setscrewed flanges to make flanged joints where conditions prevent the use of full length flanged pipe; assemble in accordance with the recommendations of the setscrewed flange manufacturer. Setscrews shall be either “Cor-Ten” steel, ductile iron or approved equal. Locking rings and Megalugs are acceptable replacements for retainer glands, but are not a replacement for thrust blocks.

c. Pipe Anchorage: Provide concrete thrust blocks, reaction backing, for pipe anchorage. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete conforming to ASTM C94 having a minimum compressive strength of 3,000 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

2. Installation of Valves and Hydrants:

a. Installation of Valves: Install gate valves conforming to AWWA C500 and UL 262 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C500. Install gate valves conforming to AWWA C509 in accordance with AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509. Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with AWWA C600 for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings.

C. Installation of Water Service Piping

1. Location: Connect water service piping to the building as described in Part 1 of this Section and as indicated.
2. Service Line Connections to Water Mains: Connect service lines to the main with a corporation stop and gooseneck and install a gate valve on service line below the frostline. Connections also to be as indicated. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.
3. Special Requirements for Installation of Metallic Piping: Metallic Piping Installation, General: Install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" and with the applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

a. Jointing:

1) Screwed Joints: Make screwed joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or an approved graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling the joint.
2) Joints for Copper Tubing: Cut copper tubing with square ends; remove fins and burrs. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing. Make solder joints using ASTM B32, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall contain not more than 0.2 percent lead. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing with a flaring tool.

D. Disinfection: Flush and disinfect new potable water lines and affected portions of existing potable water lines in accordance with AWWA C651. Apply chlorine by the continuous feed method.

3.2 FIELD QUALITY CONTROL

A. Field Tests and Inspections: The Architect and/or its representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed properly in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

B. Testing Procedure: Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper tubing joints (soldered, compression type, brazed and screwed joints.

C. Special Testing Requirements: For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be 1.5 times the working pressure or not less than 125 psi whichever is greater. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less

than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

D. Disinfection: Flush and disinfect new potable water lines/associated tanks and affected portions of existing potable water lines in accordance with AWWA C651. Apply chlorine by the continuous feed method.

END OF SECTION 221113

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.

B. Related Section:

1. Division 22 Section "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

2. Division 22 Section “General Duty Valves for Plumbing Piping” for valves.

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.

B. Water Samples: Specified in "Cleaning" Article.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 COORDINATION

A. Coordinate domestic water service installation with Site Utility Contractor. Plumbing Contractor to furnish and install underground domestic water service piping to10' outside the building. Coordinate riser stub up location with Water Service Room layout and other utilities and trades.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturer: (Only)
        1) Viega; Plumbing and Heating Systems.

    b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

    c. NPS 2-1/2 to NPS 6: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Grooved-Joint Copper-Tube Appurtenances:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Anvil International.
        2) Shurjoint Piping Products.
        3) Victaulic Company.

    b. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
    c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.

2.4 PEX TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Rehau.
2. Viega.
3. Uponor.
4. Watts.
5. Zurn.

B. PEX tube: ASTM F876 and F877, potable water tube certified to NSF standards 14 and 61. Rated 200°F at 80 psi, 180°F at 100 psi, and 73.4°F at 160 psi.

C. Fittings for PEX Tube: ASTM F1807 brass insert, compression sleeve type, or crimp fittings with joining method matching tube manufacturers requirements.

D. PEX tubing shall be installed for underslab distribution applications. Refer to Part 3.

E. PEX tubing, sizes limited to ¾" and smaller, is acceptable in walls. Refer to Part 3.

2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.6 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.7 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Description:

a. Pressure Rating: 150 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Description:

a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Description:

a. Galvanized-steel coupling.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Female threaded.
d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Description:

a. Electroplated steel nipple complying with ASTM F 1545.
b. Pressure Rating: 300 psig at 225 deg F.
c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flex-Hose Co., Inc.
2. Mercer Rubber Co.
3. Metraflex, Inc.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

2.10 WATER METERS

A. Water meters shall be furnished by Water District and installed by the Plumbing Contractor.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section

"Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping adjacent to equipment and specialties to allow service and maintenance.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install PEX piping with loop at each change of direction of more than 90 degrees.

S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

T. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

V. Install sleeves and escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

F. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. PEX Piping Joints: Join according to ASTM F 1807.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use ball valves or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings, nipples, or unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 6: Use dielectric flange kits.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

3.8 WATER METER INSTALLATION

A. Rough-in domestic water piping for water meter installation, and install water meters according to Water District's requirements. Plumbing Contractor to provide flanges and fittings required to make final connections.

B. Water meters shall be furnished by Water District and installed by the Plumbing Contractor.

C. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.9 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs: MSS Type 1, adjustable, steel clevis hangers.

3. Multiple, Straight, Horizontal Piping Runs: Support pipes on trapeze.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 and larger: 10 feet with 1/2-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install hangers for vertical PEX piping every 48 inches.

H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.11 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.13 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.14 CLEANING

A. Clean and disinfect potable and non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.15 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping shall be the following:

1. Mechanical-joint, ductile-iron pipe; standard- pattern mechanical-joint fittings; and mechanical joints.

D. Under-building-slab, domestic water supply between Trap Primer assembly and tubing serving floor drains shall be the following:

1. PEX Tube, NPS 3/4 and smaller. Fittings shall not be installed under-building slab except at final connection to floor drain. PEX tube must be sleeved with schedule 40 PVC long-sweep elbow and stub-up at slab penetration.

E. Under-building-slab, domestic water supply serving Island Plumbing Fixtures shall be the following:

1. PEX Tube, NPS 3/4 and smaller. Fittings shall not be installed under-building slab. PEX tube must be sleeved with schedule 40 PVC long-sweep elbow and stub-up at slab penetration.

F. Aboveground domestic water supply, in-wall serving individual Plumbing Fixtures, may be the following:

1. PEX Tube, limited to NPS 3/4 and smaller. Fittings shall not be installed within walls.

G. Aboveground domestic water piping, NPS 2 and smaller, shall be either of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

H. Aboveground domestic water piping, NPS 2-1/2 to NPS 6, shall be either of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.

3.16 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use ball valves or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use globe valves.
3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Temperature-actuated water mixing valves.
5. Strainers.
6. Outlet boxes.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.
11. Air vents.
12. Trap-seal primer systems.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
2.
    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.

3. Standard: ASSE 1013.
4. Operation: Continuous-pressure applications.
5. Pressure Loss: 10 psig maximum, through middle 1/3 of flow range.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved.
7. End Connections: Threaded for NPS 2 and smaller, flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.
c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller
5. End Connections: Threaded for NPS 2 and smaller.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Lawler Manufacturing Company, Inc.
b. Leonard Valve Company.
c. Powers; a Watts Industries Co.
d. Symmons Industries, Inc.

2. Performance: As Scheduled on the Drawings.

3. Standard: ASSE 1017.
4. Pressure Rating: 125 psig.
5. Type: Exposed-mounting, thermostatically controlled water mixing valve.
6. Material: Bronze body with corrosion-resistant interior components.
7. Connections: Threaded or union inlets and outlet.
8. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
9. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
10. Tempered-Water Setting: 120 deg F.
11. Valve Finish: Rough bronze.
12. Piping Finish: Copper.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

a. Strainers NPS 2 and Smaller: 0.033 inch.

6. Drain: Pipe plug.

2.6 OUTLET BOXES

A. Icemaker Outlet Boxes (Tagged WB-1):

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Guy Gray Manufacturing Co., Inc.
b. IPS Corporation.
c. Oatey.
d. Sioux Chief Manufacturing Co.
e. Symmons Industries, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Plumbing Products Group; Light Commercial Operation.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

B. Standpipe Drain Boxes:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Guy Gray Manufacturing Co., Inc.
b. IPS Corporation.
c. Oatey.
d. Sioux Chief Manufacturing Co.
e. Symmons Industries, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Plumbing Products Group; Light Commercial Operation.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
4. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.

2.7 HOSE BIBBS

A. General Interior Applications (Tagged HB-1):

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Josam Company.
b. MIFAB, Inc.

c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Woodford Manufacturing Company.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Handle:
   a. Loose key type for all public and toilet room locations.
   b. Wheel type handle for all mechanical and service locations.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Service Areas: Chrome or nickel plated.

2.8 WALL HYDRANTS

A. Non-freeze Wall Hydrants (Tagged WH-1):

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group (Basis of Design: Z1231).

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Polished Nickel Bronze.
9. Operating Keys(s): Two with each wall hydrant.

2.9 DRAIN VALVES

A. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.

5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

   a. PPP Inc.
   b. Sioux Chief Manufacturing Company, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.12 ELECTRONIC TRAP-PRIMER SYSTEM

A. Electronic Trap-Primer Controls (Tagged TP-1, TP-2)

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

   a. PPP Inc.
   b. Zurn.

2. Operation: provide a 6 second water injection to traps every 24 hours.
3. Cabinet: Galvanized steel for either surface or recessed mounting w/ cover.
4. Inlet Connections: NPS 1/2 solder joint.
5. Outlet Connections: 1/2 Male PEX connections. Provide quantity as scheduled with 5 outlets minimum.

6. Provide with the following:
   a. Electronic Module with fuse protection.
   b. Brass ball valve.
   c. Slow closing 24 VAC solenoid valve with integral strainer.

d. 120-24VAC transformer
e. Brass atmospheric vacuum breaker.
f. PEX waterway
g. Anti-scaling multi-port manifold

2.13 STANDARD TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems (Tagged TP-3)

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. PPP Inc., Model #PR-500
b. Sioux Chief Manufacturing Company, Inc.
c. Zurn.

2. Supply type trap primer valve with bronze body, 125 psig minimum working pressure.
3. Standard: ASSE 1018
4. Piping: NPS 1/2, ASTM B 88, Type L; copper, water tubing.
5. Vacuum Breaker: ASSE 1001.
6. Number Outlets: As indicated on Drawings.
7. Size Outlets: NPS 1/2.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water meters with flanges. Coordinate companion flanges sizes with water meter furnished ny Water District.

D. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

F. Install Y-pattern strainers for water on supply side of each, water pressure-reducing valve,.

G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201. Sizes shall be per manufacturer's recommended sizing method based on fixture unit load of connected fixtures.

I. Install air vents at high points of water piping.

J. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

2. Test each electronic trap primer system.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

C. Set field-adjustable electronic trap primer systems.

END OF SECTION 221119

SECTION 221133 - NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.

2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.

B. Welding certificates.

C. Field quality-control reports.

D. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

B. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    c. Aboveground Portion: PE transition fitting.
    d. Outlet shall be threaded or flanged or suitable for welded connection.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    b. Outlet shall be threaded or flanged or suitable for welded connection.
    c. Bridging sleeve over mechanical coupling.
    d. Factory-connected anode.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

5. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.

    a. PE body with molded-in, stainless-steel support ring.
    b. Buna-nitrile seals.

c. Acetal collets.
d. Electro-zinc-plated steel stiffener.

6. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Fiber-reinforced plastic body.
b. PE body tube.
c. Buna-nitrile seals.
d. Acetal collets.
e. Stainless-steel bolts, nuts, and washers.

7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Stainless-steel flanges and tube with epoxy finish.
b. Buna-nitrile seals.
c. Stainless-steel bolts, washers, and nuts.
d. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.

B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. See Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.

2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.

1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig.
6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.
4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig.

8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ASCO Power Technologies, LP; Division of Emerson.
    b. Dungs, Karl, Inc.
    c. Eaton Corporation; Controls Div.
    d. Eclipse Combustion, Inc.
    e. Honeywell International Inc.
    f. Johnson Controls.

2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. Normally closed.
6. Visual position indicator.
7. Mechanical operator for actuation by appliance automatic shutoff device.

B. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ASCO Power Technologies, LP; Division of Emerson.
    b. Dungs, Karl, Inc.
    c. Eclipse Combustion, Inc.
    d. Goyen Valve Corp.; Tyco Environmental Systems.
    e. Magnatrol Valve Corporation.
    f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
    g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Furnished and installed by Utility, Bangor Gas.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Actaris.
    b. American Meter Company.
    c. Eclipse Combustion, Inc.
    d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    e. Invensys.
    f. Maxitrol Company.
    g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Eaton Corporation; Controls Div.
    b. Harper Wyman Co.
    c. Maxitrol Company.
    d. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.

8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.7 SERVICE LINE

A. Service line from street to downstream of meter to customer connection shall be designed, furnished and installed by Utility, Unitil.

2.8 SERVICE METERS

A. Meter assembly shall be designed, furnished, and installed by Utility, Unitil.

2.9 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Minimum Operating-Pressure Rating: 150 psig.
2. Combination fitting of copper alloy and ferrous materials.
3. Insulating materials suitable for natural gas.
4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Minimum Operating-Pressure Rating: 150 psig.
2. Combination fitting of copper alloy and ferrous materials.
3. Insulating materials suitable for natural gas.
4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Minimum Operating-Pressure Rating: 150 psig.
2. Companion-flange assembly for field assembly.
3. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.10 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Utility, Bangor Gas, shall provide underground natural gas service line to building.

C. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

D. Install underground, PE, natural-gas piping according to ASTM D 2774.

E. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved by Engineer.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

4. <u>Prohibited Locations:</u>

    a. <u>Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.</u>
    b. <u>Do not install natural-gas piping in solid walls or partitions.</u>

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator.

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Furnished and installed by Utility, Unitil.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.7 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.

3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.9 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and piping specialties, except components, with factory-applied paint or protective coating.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be the following:

1. Steel pipe with wrought-steel fittings and welded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branches to final connections, NPS 1 and smaller shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with steel welding fittings and welded joints.

3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves at service meter shall be furnished and installed by Utility, Unitil.

B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.

C. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Cast-iron, lubricated plug valve.

D. Valves in branch piping for single appliance shall be one of the following:
   1. Two-piece, full-port, bronze ball valves with bronze trim.
   2. Bronze plug valve.

END OF SECTION 221133

SECTION 221313 – FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers work related to exterior sanitary sewer collection and conveyance systems shown on drawings and specifications.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities procedures.
2. Division 22 Section "Plumbing" for roof drain and sanitary sewer services connections.
3. Division 32 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.
4. Division 31 Section "Earth Moving for Utilities" for soil materials, excavating, backfilling.
5. Division 31 Section "Dewatering" for requirements and guidelines for dewatering procedures.
6. Division 31 Section “Excavation Support and Protection" for requirements and guidelines for dewatering procedures.
7. See other related Division 22 sections for additional requirements governing floor drain and sanitary service piping within the building.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI A14.3	2008 Ladders-Fixed-Safety Requirements

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C94	2009 Ready-Mixed Concrete
ASTM C443	2005 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478	2009 Precast Reinforced Concrete Manhole Sections
ASTM C700	2007 (Rev. A) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated

ASTM C923	2008 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C969	2002 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM D2412	2002 (Rev. 2008) External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D3034	2008 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3139	1998 (Rev. 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	2007 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D4101	2008 Polypropylene Plastic Injection and Extrusion Material
ASTM F405	2005 Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F477	2008 Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	2008 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water (ANSI/AWWA C104/A21.4)
AWWA C110/A21.10	2008 Ductile-Iron and Gray-Iron Fittings
AWWA C111/A21.11	2006 Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C153/A21.53	2006 Ductile-Iron Compact Fittings, 3 in. through 16 in., for Water and Other Liquids
AWWA C600	2005 Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C900	2007 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution

FEDERAL SPECIFICATIONS (FS)

FS RR-F-621	1998 (Rev. E) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)

UNI B31992 Installation of Polyvinyl Chloride (PVC) Pressure Pipe

UNI B51989 Installation of Polyvinyl Chloride (PVC) Sewer Pipe

UNI B61990 Low-Pressure Air Testing of Installed Sewer Pipe

1.4 SUBMITTALS

A. Manufacturer's Catalog Data: Submit manufacturer's standard drawings or catalog cuts.

1. Fittings
2. Joints and couplings
3. Piping
4. Riser-wrap

B. Drawings

1. Precast concrete manholes
2. Metal work

1.5 PROJECT CONDITIONS

A. The General Contractor shall be responsible for all fees, permits and coordination with the local utility company related to the connection to the existing municipal sanitary sewer system.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

B. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

C. Cement, Aggregate, and Reinforcement: As specified in Section 033000.

D. Handling: Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition.

PART 2 - PRODUCTS

2.1 PIPELINE MATERIALS

A. PVC Plastic Gravity Sewer Piping

1. PVC Plastic Gravity Pipe and Fittings: ASTM D3034, SDR 35, with ends suitable for elastomeric gasket joints. The pipe shall be colored green to identify it for sewer applications.

B. Sewer Pipe Saddles: Provide pipe saddles in types as indicated on the Drawings. Strap-on sewer saddles are cast iron with a stainless steel saddle strap. Provide manufacturer's standard bolts, nuts, and mastic sealing compound with each saddle. Provide straps in sizes as required by pipe size.

C. Acceptable products/manufacturers are:

1. EJP, Inc.

2. Ipex Inc.
3. Hancor Pipe
4. ADS Pipe
5. North American Pipe
6. Approved equal.

D. Detection Materials: Provide detectable tape, or detection plates at all buried clean outs.

2.2 CONCRETE MATERIALS

A. Concrete materials shall be as specified in Section 033000.

2.3 MISCELLANEOUS MATERIALS

A. Precast Concrete and Associated Materials

1. Precast Concrete Manhole Sections: Precast concrete manhole risers, base sections, and tops shall conform to ASTM C478. Base and first riser shall be monolithic. All concrete shall have a minimum ultimate compressive strength of 4000 psi at the end of 28 days. Standard is by American Concrete Co. and Superior Concrete Co.
2. Protective Coating: Plant-applied damp proofing is required for all exterior concrete surfaces for all sanitary structures.
3. Gaskets and Connectors: Gaskets for joints between manhole sections shall conform to ASTM C443. Standard is Kent-Seal. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923.

B. Metal Items

1. Frames and Covers: Unless otherwise indicated on the drawings or specified, frames and covers shall be gray cast iron conforming to ASTM A 48/A 48M -03, Class 30B and suitable for AASHTO H 20-44 and HS 20-44 highway loading. Provide non-skid surface with raised letter "SEWER" designation cast on the cover. Acceptable products/manufacturers shall be:
   a. Etheridge E24X5 cats iron manhole frame and cover or approved equal;

2. Manhole Steps: Zinc-coated steel conforming to ANSI A14.3. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D4101, copolymer polypropylene. Rubber shall conform to ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

C. Riser-wrap

1. Riser-Wrap is supplied in bulk rolls along with Polyken #1027 liquid adhesive (furnished in 1-gallon cans) and 6” wide joiner- strips.
2. All Riser-Wrap coating material shall be stored, handled, and transported in such a manner as to prevent damage to individual carton or containers. Cartons, sleeve rolls, joiner-strips or individual repair sleeves removed from the storage pallets shall not be dropped, rolled, or thrown in any manner as to damage the coating material. Cartons or sleeve rolls shall not be handled with hooks, ropes, cables, or any other mechanical devices as to damage the coating materials.

3. Factory rolls and/or cartons shall be stacked on end at all times and no higher than seventy-two (72) inches.
4. The coating material shall be stored and/or transported in a dry, ventilated location. Storage temperature shall be a minimum of 4 °F and not to exceed 130 °F.
5. Individual cartons or rolls of coating material shall not contact bare ground or bare warehouse floor. Tools or equipment shall not be stacked on top of the rolls.
6. Riser-Wrap materials that have been damaged or show signs of deterioration shall be inspected by representatives of the owner and at the discretion of the end-user may be rejected.
7. Riser-Wrap sleeves are supplied with a plastic release liner on the adhesive side. This release liner is required to prevent the highly aggressive adhesive from prematurely bonding to itself and protect the adhesive surface from contamination. It should not be removed until time of application.
8. Polyken #1027 liquid adhesive shall be stored in accordance with regulations that govern hazardous material storage. Primer inventory shall rotate on a first in - first out basis. Primer containers shall be marked with receiving date.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

A. General Requirements for Installation of Pipeline: Apply except where specific exception is made in the following paragraphs entitled, "Special Requirements."

1. Location: The work covered by this section shall terminate at a point approximately 10 feet from the building, unless otherwise indicated. Where the location of the sewer is not clearly defined by dimensions on the drawings, do not lay sewer line closer horizontally than 10 feet to a water main or service line. Where sanitary sewer lines pass above water lines, encase sewer in concrete for a distance of 10 feet on each side of the crossing, or substitute rubber-gasketed pressure pipe for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, lay pipe so that no joint in the sewer line will be closer than 3 feet, horizontal distance, to the water line.
2. Earthwork: Perform earthwork operations in accordance with Section 312100.
3. Pipe Laying and Jointing: Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.
   a. Lay nonpressure pipe with the bell ends in the upgrade direction.
   b. Lay pressure pipe with the bell ends in the downgrade direction, or in other words the pressurized flow should hit the bell end of the pipe first.
4. Connections to Existing Lines: Obtain approval from the Architect before making connection to existing line. Conduct work so that there is minimum interruption of service on existing line. Obtain and pay for any permits needed to connect to existing lines. Contact the local utility company two days before making connection to existing lines. Follow regulations of local utility company related to connecting to their lines. Regrade and repair areas as needed to restore surfaces to existing features.

B. Special Requirements

1. Installation of PVC Plastic Piping: Install pipe and fittings in accordance with paragraph entitled, "General Requirements for Installation of Pipelines" of this section and with the requirements of UNI B5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of UNI B5 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
2. Cleanouts: Construct cleanouts of PVC sanitary pipe and fittings with cleanout cover.

C. Concrete Work: Cast-in-place concrete is included in Section 033000.

D. Manhole Construction: Use precast concrete base sections. Make inverts in precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent sewer sections. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert of as large a radius as manhole size will permit. No parging will be permitted on interior manhole walls. For precast concrete construction, make joints between manhole sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Parging will not be required for precast concrete manholes. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as necessary to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding into the manhole. Use resilient connectors as previously specified for pipe connectors to concrete manholes.

E. Riser-Wrap/Joint Sealing Installation

1. The exterior of the manhole or vault shall be brushed by broom or hand wire tools to remove any loose cement dust or small rock particles from the surface. Sharp edges or points should be also removed or flattened.
2. Preheating is only necessary below when ambient temperatures are below 60 °F and/or moisture is apparent on the surface. The function of preheating is primarily to remove excess moisture and warm the surface where Riser-Wrap is to be installed. In many cases, preheating may not be required.
3. Visible oil and/or grease shall be removed by use of a suitable solvent. Kerosene shall not be used for solvent cleaning.
4. Cleaned surfaces of manhole sections shall not be allowed to sit for extended periods under wet or humid conditions prior to the application of the Riser-Wrap system.
5. Dust and/or other loose materials shall be removed prior to application of primer by dry air blow or broom brushing.
6. The joint sealing system shall always be applied on top of the Polyken #1027 or #1039 liquid adhesive primers.
7. The primer shall be thoroughly mixed prior to application. The primer is applied to the concrete surface with a brush or paint roller to a wet thickness of no less than two (2) mils and no greater than five (5) mils. Primer container shall remain covered when not in use.
8. The primer shall cover the entire exposed concrete surface and manhole cover frame including the indentations caused by the irregular concrete surface where the Riser-Wrap material is to be installed.
9. The primer shall be "dry to touch" prior to the application of the Riser-Wrap. Under no circumstances shall the sleeve be applied over a wet primer surface.
10. The primer shall not be diluted. Primer cans shall remain covered when not in use, to avoid solvent evaporation or contamination and shall be disposed of properly.

11. For street surface enclosures allow approximately 5” of sleeve material to extend upward above the manhole cast iron ring (manhole cover frame). This excess material will fold down over the ring during application. Note that concrete manhole cones have changing circumferences. Always measure the sleeve twice prior to cutting from the longest (largest circumference) place where sleeve is to be installed.
12. Remove 8” of liner from back of sleeve and attach the edge vertically to the manhole section. Hold edge in place and begin to unroll sleeve along marked line; removing liner as you move around the manhole cone section until you have overlapped the starting edge.
13. Using a small amount of flame, heat the adhesive side of the joiner-strip (white textured side) and place the 6” wide joiner-strip vertically across the overlapped sleeve edges (black side out). Hold in-place and apply a small amount of heat to the joiner-strip while gently patting it down with a gloved hand. Adjust torch to medium-high output and begin heating the sleeve (minimum of 6” from joiner-strip) along the bottom edge of Riser-Wrap, moving in one direction and keeping the torch moving in a continuous up and down motion. Continue heating sleeve towards top edge, watching the sleeve closely, so adhesives edges do not touch.
14. Use roller to move adhesive towards outer sleeve edges and to remove wrinkles or bubbles. Do not cut sleeve to remove wrinkles.
15. The Riser-Wrap embossed sleeve outer surface informs the applicator that the sleeve is thoroughly heated when the embossment disappears and also when the adhesive is showing on the outer edges. This is a permanent indicator and provides the inspector information that the heating process has been completed.
16. Do not cut the Riser-Wrap sleeve while applying over cast iron manhole gussets. Gently fold the heated sleeve around them. Cuts can be made later after the Riser-Wrap has cooled to ambient temperature if desired.
17. For complete encapsulation application-begin installation at lowest point, applying sleeves upward in layers that overlap the previous sleeve by 2”. Also, the vertical placement of the joiner-strips on each successive wrap should be horizontally staggered to avoid vertical stacking.
18. Filler cord material may be required for step-downs exceeding 1” in variation and/or to repair damaged concrete areas or cover sharp protrusions that cannot be removed by other means.

F. Miscellaneous Construction and Installation

1. Metal Work: Workmanship and Finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron to shape and size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide necessary rabbets, lugs, and brackets wherever necessary for fitting and support.

3.2 FIELD QUALITY CONTROL (Note: Also perform all testing required by the local utility company)

A. Field Tests and Inspections: The Architect or representative will conduct field inspections and witness field tests specified in this section.

B. Leakage Tests: Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

C. Low-pressure Air Tests: Perform tests as follows:

1. The contractor shall test the gravity sewer with a low-pressure air test. After completing backfill of a section of wastewater line, the contractor shall at his own expense, conduct a Line Acceptance Test using low pressure air.

   The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease as stated below (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

   a. PVC Plastic Pipelines: Test all new lines at 4 psi with an allowable pressure drop of one (1) psi at the following durations for a specific pipe diameter size:

- 15" diameter – 17 minutes
- 12" diameter – 11.5 minutes
- 10" diameter – 8 minutes
- 8" diameter – 5 minutes
- 6" diameter – 4 minutes
- 4" diameter – 4 minutes

D. Internal pressure tests for force mains:

1. All force mains shall be tested per the testing requirements:
   a. conduct all pressure and leakage testing in accordance with AWWA standards
   b. Decrease pressure in the main to be tested approximately 20 psi. Observe test gauge to ensure the pressure doesn't rise due to an existing valve or tapping valve leaking by. This is done to ensure that no undisinfected water from the installed main enters the existing main while performing the actual test
   c. A pressure test pump shall be connected to the new main at the testing point. The pressure will be slowly increased to 150 psig and allowed to stabilize (+/- 2.5 psig) for a minimum of 15 minutes.
   d. A reservoir of potable water shall be connected to the test pump and the initial level of water recorded.
   e. The pump pressure shall be maintained at 150 psig for a minimum of 1 hour with all makeup water withdrawn from the reservoir.
   f. After one hour, the water level in the reservoir will be measured and the volume of water drawn down from the reservoir calculated and compared with the following allowable leakage:

      Allowable leakage (ounces per hour) – (pipe length (feet) X Nominal Diameter (inches) x128)/10,900

   g. If any test discloses leakage greater than that specified above, the contractor, at his own expense, shall locate the leak and make repairs as necessary until the leakage is within the specified allowance. Written certification of leakage and pressure testing shall be submitted to the engineer upon completion.

E. Deflection Testing: Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

1. Pull-through Device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

    a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
    b. Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.
    c. Center bored and through-bolted with a 1/4-inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
    d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

2. Deflection Measuring Device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.
3. Pull-through Device Procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.
4. Deflection Measuring Device Procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe, which has excessive deflection, and completely retest in same manner and under same conditions.

F. Tests for Manholes

1. Vacuum Test: The manhole being tested must not be backfilled. The test is passing if the manhole holds 10 inches of mercury vacuum for 3 minutes with one inch of mercury allowable loss. Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

G. Field Tests for Concrete: Field testing requirements are covered in Section 033000.

END OF SECTION 221313

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Division 11 Section “Food Service Equipment” for Commissary Kitchen and Concessions plumbing fixtures specified and provided with Food Service package to be installed and final connections by Plumbing Contractor.

2. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type DWV, water tube, drawn temper.

D. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent Cement: ASTM D 2564.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Nonpressure Transition Couplings:

a. Standard: ASTM C 1460.
b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

4. Pressure Transition Couplings:

a. Standard: AWWA C219.
b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
c. Center-Sleeve Material: Ductile iron.
d. Gasket Material: Natural or synthetic rubber.
e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F 250 psig.

3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Description:

1) Electroplated steel nipple complying with ASTM F 1545.
2) Pressure Rating: 300 psig at 225 deg F.
3) End Connections: Male threaded or grooved.
4) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Install drain, waste, and vent piping systems in strict accordance with State and Local codes and AHJ.

B. Coordinate all drain exits at building foundation wall and penetrations.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install piping to allow application of insulation.

L. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

M. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

N. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

O. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Sanitary Drain and Waste: 1/4 inch/foot downward in direction of flow for piping.
2. Vent Piping: slope down toward vertical fixture vent or toward vent stack.

P. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

Q. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

R. Install underground PVC piping according to ASTM D 2321.

S. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug

inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."

3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

U. Install sleeves escutcheons and for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
3. Dielectric Fittings for NPS 2-1/2 and larger: Use dielectric flange kits.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sump pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.

2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

K. Install supports for vertical PVC piping every 48 inches.

L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves in pit with pit cover flush with floor.
6. Comply with requirements for backwater valves cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

Aboveground, exposed, Soil, Waste, Vent, and Indirect Waste Vent piping shall be the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

2. Copper DWV tube, DWV pattern fittings, and soldered joints acceptable for 2" and smaller above grade DWV piping.

B. Aboveground, concealed, Soil, Waste, Vent, and Indirect Waste Vent piping shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, Indirect Waste piping (Food Service and Concession Areas) shall be the following:

1. Copper DWV tube, copper drainage fittings, and soldered joints.

D. Aboveground, Condensate Drain piping (Mechanical Equipment) shall be the following:

1. Exposed locations, Copper DWV tube, copper drainage fittings, and soldered joints.
2. Concealed locations, Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground force mains (sump pump discharge) shall be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

F. Underground, Soil, Waste, and Vent piping shall be either of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground, Kitchen/Grease Waste and Vent piping (Food Service Area) shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Floor sinks.
4. Miscellaneous sanitary drainage piping specialties.
5. Channel drain system.
6. Interceptors.

B. Related Sections include the following:

1. Division 11 Section “Food Service Equipment” for Commissary Kitchen and Concessions plumbing fixtures specified and provided with Food Service package to be installed and final connections by Plumbing Contractor.

2. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. HDPE: High-density polyethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories

B. Shop Drawings: Detailed layouts of each channel drain system. Include modular sections, inverts, inlets and outlets, and grates.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of roof penetrations for vents and roof drains.

B. Coordinate floor drain and cleanout rough-in elevation and final adjustment with finish floor elevations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.
b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
c. Tyler Pipe; Wade Div.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Basis of Design: Zurn Z1400.

3. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
4. Size: Same as connected branch.
5. Type: Adjustable housing.

6. Body or Ferrule: Cast iron.
7. Clamping Device: Required.
8. Outlet Connection: Inside calk.
9. Closure: Brass plug with tapered threads.
10. Adjustable Housing Material: Cast iron.
11. Frame and Cover Material and Finish: Rough bronze.
12. Frame and Cover Shape: Round.
13. Top Loading Classification: Medium Duty.
14. Riser: ASTM A 74, service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Basis of Design: Zurn Z1441.

3. Standard: ASME A112.36.2M. Include wall access.
4. Size: Same as connected drainage piping.
5. Body: as required to match connected piping.
6. Closure: Countersunk or raised-head, brass plug.
7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
8. Wall Access: Round, cover plate with screw.
9. Wall Access: Nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Basis of Design:
   a. FD-1: Zurn ZN415B
   b. FD-2: Zurn Z511-G-P-Y, 9” heavy duty drain with sediment bucket.
   c. FD-3: Zurn Z415B with 4” diameter funnel.

3. Standard: ASME A112.6.3.

4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top of Body and Strainer Finish:
   a. FD-1: Nickel bronze.
   b. FD-2: Galvanized ductile iron.
   c. FD-3: Nickel bronze.
10. Top Shape: Round.
11. Funnel: Provide in locations as indicated on the Drawings.
12. Inlet Fitting: Gray iron, with threaded inlet trap-seal primer supply connection.

2.3 FLOOR SINK RECEPTOR

A. Cast-Iron Receptor:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Basis of Design:
   a. FS-1: Zurn Z1901 12”x12”x8” deep, white acid resistant porcelain enamel and top, with Z1903 installation stabilizer. Outlet size as scheduled on the drawings.

   b. FS-2: Zurn Z1901 12”x12”x8” deep, white acid resistant porcelain enamel and top, with Z1903 installation stabilizer. Outlet size as scheduled on the drawings.

3. Standard: ASME A112.6.3.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Top of Body and Strainer Finish:
   a. FS-1: ½ grate.
   b. FS-2: ½ grate.
10. Top Shape: square.
11. Grate: Provide in type as required in locations as indicated on the Drawings.
12. Inlet Fitting: Gray iron, with threaded inlet trap-seal primer supply connection.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

2.5 CHANNEL DRAINAGE SYSTEMS (PH2)

A. Plastic Channel Drainage Systems (Tagged TD-1, Laundry Room):
1. Manufacturer:
a. Zurn Plumbing Products Group; Perma-Trench.
1) Basis of Design: Zurn Z882-8203-E1-U4-GDC-DB

2. Provide lengths, size, configuration, and outlet in locations as indicated drawings.

3. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

a. Channel Sections: Interlocking-joint, HDPE modular 8’ long unit with inclined bottom, minimum 8” deep shallow invert.

1) Dimensions: 12 inches wide. Include number of units required to form total lengths indicated on the drawings.

b. Accessory Options: Provide end cap, bottom outlet, and bottom dome strainer.

c. Grates: With slots and widths and thickness that fit recesses in channel sections.

1) Material: Galvanized Ductile iron Slotted Grate, Class C.

d. Supports, Anchors, and Setting Devices: Heavy-duty frame assembly with anchor studs.

e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.6 INTERCEPTORS

A. Grease Interceptors:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Rockford Sanitary Systems, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products Inc.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation wastewater.
3. Plumbing and Drainage Institute Seal: Required.
4. Body Material: Cast iron.
5. Interior Lining: Corrosion-resistant enamel.
6. Exterior Coating: Corrosion-resistant enamel.
7. End Connections: Hub.
8. Cleanout: Integral or field installed on outlet.
9. Mounting: Above floor.
10. Flow-Control Fitting: Required.
11. Operation: Manual cleaning.
12. Sizes and Basis of Design as scheduled on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

G. Assemble open drain fittings and install with top of hub 2 inches above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to ALL floor drains and ALL floor sinks trap-seal primer connection.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
1. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

L. Install wood-blocking reinforcement for wall-mounting-type specialties.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221323 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of interceptors outside the building:

1. Exterior Grease Interceptors.
2. Exterior oil/water separator.

B. Related Sections include the following:

1. Section 312000 – Earth Moving for Structures and Pavements
2. Section 312100 – Earth Moving for Utilities
3. Section 221313 – Facility Sanitary Sewers
4. Section 221353 – Facility Septic Tanks
5. Section 033000 - Cast-In-Place Concrete
6. Division 22 - Plumbing Systems

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. HDPE: High-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PP: Polypropylene plastic.

1.4 SUBMITTALS

A. Shop Drawings of all items specified herein shall be submitted for approval in accordance with the requirements of Section 013300 - Submittals. Shop Drawings shall show size, arrangement of incoming and outgoing lines, concrete strength, and reinforcing. Approval must be received before fabrication is started.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, damp proofing and accessories.
2. Materials for Metal Work (frames and covers)

1.5 PROJECT CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of service.
2. Do not proceed with interruption of sewer services without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified by American Concrete Company, Superior Concrete or approved equal.

2.2 EXTERIOR GREASE INTERCEPTORS

A. Grease Interceptors: Precast concrete complying with ASTM C 913. Include rubber-gasketed joints, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.

1. Protective Coating: Plant-applied damp proofing to all exterior concrete surfaces for all sanitary structures.
2. Structural Design Loads:

a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).

3. Gaskets and Connectors: Gaskets for joints between sections shall conform to ASTM C443. Standard is Kent-Seal. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923.

B. Grease Interceptor Capacity and Characteristics:

1. Length by Width by Depth: Length and width per manufacturer’s recommendations for the size capacity indicated on the drawings.
2. Number of Compartments: As indicated on the Drawings.
3. Retention Capacity: 3,000 gallons
4. Inlet and Outlet Pipe Size and elevations: As indicated on the Drawings.
5. Installation Position: Underground with manhole riser to grade
6. Metal Work: Provide frames and covers as indicated in the drawings and specified herein.

2.3 PRECAST CONCRETE MANHOLE RISERS

A. Precast Concrete Manhole Risers: ASTM C 478, with rubber-gasket joints.

1. Structural Design Loads:

   a. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).

2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch minimum thickness
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Zinc-coated steel conforming to ANSI A14.3. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D4101, copolymer polypropylene. Rubber shall conform to ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Steps are not required in manholes less than 4 feet deep.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

C. Protective Coating: Plant-applied damp proofing to all exterior concrete surfaces for all sanitary structures.

D. Manhole Frames and Covers: FS RR-F-621, cast iron; standard is Model R-1733A (solid lid with two lift holes) by Neenah Foundry Co. 8" high, 485 lbs. weight. Manholes in traffic areas to have H20 wheel loading rated covers. The word “SEWER” shall be cast on cover.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving for Utilities."

3.2 INSTALLATION

A. Install interceptor inlets and outlets at elevations indicated.

B. Install precast concrete interceptors according to ASTM C891. Set level and plumb.

C. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

D. Set tops of manhole frames and covers flush with finished surface in pavements.

E. Set tops of grating frames and grates flush with finished surface.

F. Clean and prepare concrete surfaces to be field painted. Remove loose efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen surface as required to remove glaze. Paint the following concrete surfaces as recommended by paint manufacturer:

G. Clean and prepare metal surfaces to be field painted according to SSPC- PA 1. Paint the following metal surfaces according to SSPC-PA 1 and SSPC-Paint 16:

1. Metal Manhole Frames and Covers: All surfaces.
2. Do not paint metal surfaces with factory-applied, corrosion-resistant coating.

H. Repair and restore protective coatings to original condition.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Identification materials and installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.5 FIELD QUALITY CONTROL (Note: Also perform all testing required by the local utility company)

A. Field Tests and Inspections: The Architect or representative will conduct field inspections and witness field tests specified in this section.

B. Leakage Tests: Test lines for leakage by either infiltration tests or exfiltration tests, or by low-pressure air tests. Prior to testing for leakage, backfill trench up to at least lower half of pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe sufficient to prevent movement, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

C. Low-pressure Air Tests: Perform tests as follows:

1. PVC Plastic Pipelines: Test all new lines at 4 psi with an allowable pressure drop of one (1) psi at the following durations for a specific pipe diameter size:
   - 10” diameter – 6 minutes
   - 8” diameter – 4 minutes
   - 6” diameter – 3 minutes
   - 4” diameter – 2 minutes

D. Deflection Testing: Perform a deflection test on entire length of installed plastic pipeline on completion of work adjacent to and over the pipeline, including leakage tests, backfilling, placement of fill, grading, paving, concreting, and any other superimposed loads determined in accordance with ASTM D2412. Deflection of pipe in the installed pipeline under external loads shall not exceed 4.5 percent of the average inside diameter of pipe. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.

1. Pull-through Device: This device shall be a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section. Pull-through device may also be of a design promulgated by the Uni-Bell Plastic Pipe Association, provided the device meets the applicable requirements specified in this paragraph, including those for diameter of the device, and that the mandrel has a minimum of 9 arms. Ball, cylinder, or circular sections shall conform to the following:

    a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
    b. Homogeneous material throughout, shall have a density greater than 1.0 as related to water at 39.2 degrees F, and shall have a surface Brinell hardness of not less than 150.
    c. Center bored and through-bolted with a 1/4-inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
    d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.

2. Deflection Measuring Device: Sensitive to 1.0 percent of the diameter of the pipe being tested and shall be accurate to 1.0 percent of the indicated dimension. Deflection measuring device shall be approved prior to use.
3. Pull-through Device Procedure: Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions.
4. Deflection Measuring Device Procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, replace pipe, which has excessive deflection, and completely retest in same manner and under same conditions.

E. Tests for Manholes

1. Vacuum Test: The manhole being tested must not be backfilled. The test is passing if the manhole holds 10 inches of mercury vacuum for 3 minutes with one inch of mercury allowable loss. Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

F. Field Tests for Concrete: Field testing requirements are covered in Section 033000.

END OF SECTION 221323

SECTION 221413 - STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:
1. Division 33 Section "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service classes.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent Cement: ASTM D 2564.

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.

3. Shielded, Nonpressure Transition Couplings:

   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

A. Install drain piping systems in strict accordance with State and Local codes and AHJ.

B. Coordinate all drain exits at building foundation wall and penetrations.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install piping to allow application of insulation.

L. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

M. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers

and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

N. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

O. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Storm Drain: 1/4 inch/foot downward in direction of flow for piping NPS 4 and smaller; 1/8 inch/foot downward in direction of flow for piping NPS 5 and larger.

2. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

3. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

P. Install underground PVC piping according to ASTM D 2321.

Q. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Storm Drainage Piping Specialties."
2. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Storm Drainage Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves and escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

D. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

I. Install supports for vertical PVC piping every 48 inches.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Aboveground, exposed, storm drainage piping shall be the following:
1. Hubless, cast-iron soil pipe and fittings; CISPI heavy-duty hubless-piping couplings; and coupled joints.

B. Aboveground, concealed, storm drainage piping shall be the following:
1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Underground storm drainage piping shall be either the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following storm drainage piping specialties:

1. Roof Drains.
2. Combination Roof drains.
3. Overflow Downspout Nozzles.

B. Related Sections include the following:

1. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains, and specialties connected to sanitary sewer.

1.3 SUBMITTALS

A. Product Data: For roof drains.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.5 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 ROOF DRAINS

A. Main Roof Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.

c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Basis of Design: Zurn ZC100 15" diameter low silhouette main roof drain.

3. Standard: ASME A112.21.2M.
4. Pattern: Roof drain.
5. Body Material: Cast iron.
6. Outlet: Bottom.
7. Dome Material: Cast or ductile iron.
8. Extension Collars: Required.
9. Underdeck Clamp: Required.
10. Sump Receiver: Required.

B. Combination Roof Main Drain and Overflow Roof Drains:

1. Basis of Design: Zurn Z163, (2) 15" diameter drain bodies.

2. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Froet Industries, LLC (100 Series Bi-functional Roof Drain)
b. Josam Company; Josam Div.
c. MIFAB, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.21.2M.
4. Pattern: Roof drain.
5. Body Material: Cast iron.
6. Outlet: Bottom.
7. Dome Material: Cast or ductile iron.
8. Extension Collars: Required.
9. Underdeck Clamp: Required.
10. Sump Receiver: Required.

C. Overflow Downspout Nozzles:

1. Basis of Design: Zurn ZAB-199-SS

2. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Description: Polished nickel bronze, with no-hub inlet, decorative face of wall flange and outlet nozzle, with stainless steel screen.

D. Refer to drawings for outlet sizes and locations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions. Roofing materials are specified in Division 07.

1. Install roof-drain flashing collar or flange so that there will be no leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Position roof drains for easy access and maintenance.

C. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

D. Install Overflow Downspout Nozzles at all overflow roof drain outlets. Locations thru exterior walls indicated on plumbing plans (tagged RWO).

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 221429 - SUMP PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Packaged drainage-pump units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 PACKAGED DRAINAGE-PUMP UNITS

A. Packaged Submersible Drainage-Pump Units:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Stancor.
b. Zoeller Company (Basis of Design).

2. Description: Factory-assembled and -tested sump-pump unit, specifically for elevator pit service, with oil sensing controls.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM B 584, cast bronze, design for clear wastewater handling, and keyed and secured to shaft.
6. Pump Seal: Mechanical.
7. Motor: Hermetically sealed, capacitor-start type, with built-in overload protection.
8. Power Cord: Three-conductor, waterproof cable of length required but not less than 72 inches, with grounding plug and cable-sealing assembly for connection at pump.

9. Control: Motor-mounted float switch.

10. Control-Interface Features:

a. Remote Alarm Contacts: For remote alarm interface.
b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

11. Capacity and Characteristics: As Scheduled on the Drawings.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Elevator pit sump pump discharge piping must be routed and indirectly connected to the sanitary drainage system.. No direct connection shall be permitted. No connection shall be permitted to storm drain system, to the surface, or to grade.

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Terms and Conditions and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:
   1. Water closets.
   2. Urinals.
   3. Lavatories.
   4. Sinks.
   5. Showers.
   6. Service basins.
   7. Drinking Fountains.
   8. Protective shielding guards.
   9. Fixture supports.

B. Related Sections include the following:
   1. Division 6 Section “Interior Architectural Woodwork” for solid surface fixtures and casework.
   2. Division 10 Section "Toilet, Bath, and Laundry Accessories."
   3. Division 11 Section “Food Service Equipment” for Commissary Kitchen and Concessions plumbing fixtures specified and provided with Food Service package to be installed and final connections by Plumbing Contractor.
   4. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, mixing valves, trap primers, service outlet boxes, and specialty fixtures.
   5. Division 22 Section "Domestic Waste Piping Specialties" for floor drains, floor sinks, stand drains and specialty fixtures.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

D. PMMA: Polymethyl methacrylate (acrylic) plastic.

E. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
1. Plastic Mop-Service Basins: ANSI Z124.6.
2. Plastic Shower Enclosures: ANSI Z124.2.
3. Slip-Resistant Bathing Surfaces: ASTM F 462.
4. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
5. Vitreous-China Fixtures: ASME A112.19.2M.
6. Water-Closet, Flush Valve, Trim: ASME A112.19.5.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.

6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
3. Deck-Mounted Bath/Shower Transfer Valves: ASME 18.7.
4. Faucets: ASME A112.18.1.
5. Hand-Held Showers: ASSE 1014.
6. High-Temperature-Limit Controls for Thermal-Shock-Preventing Devices: ASTM F 445.
7. Hose-Coupling Threads: ASME B1.20.7.
8. Manual-Control Antiscald Faucets: ASTM F 444.
9. Pipe Threads: ASME B1.20.1.
10. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
11. Thermostatic-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.

J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Manual-Operation Flushometers: ASSE 1037.
5. Brass Waste Fittings: ASME A112.18.2.

K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Dishwasher Air-Gap Fittings: ASSE 1021.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit.
b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period for Commercial Applications: One year(s) from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
4. Water-Closet flush valve, repair kits: Equal to 5 percent of amount of each type installed.
5. Toilet Seats: Equal to 5 percent of amount of each type installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Vitreous China Fixtures:
1) American Standard Companies, Inc.
2) Eljer.
3) Kohler.
4) Sloan.
5) Zurn.

b. Waterfree Fixtures:
1) Falcon.

c. Flushometers:
1) Sloan.

d. Toilet Seats:
1) Bemis Manufacturing Company.
2) Church Seats.
3) Olsonite Corp.

e. Fixture Supports
1) MIFAB Manufacturing Inc.
2) Smith, Jay R. Mfg. Co.
3) Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
4) Zurn Plumbing Products Group; Specification Drainage Operation.

f. Stainless Steel Sinks:
1) Elkay.
2) Just.

g. Faucets:

1) Chicago Faucets.
2) Kohler.
3) Sloan.
4) T & S Brass and Bronze Works, Inc.

h. Showers:
1) Acryline USA, Inc.
2) Aquaglass
3) Aquabath.
4) Aquarius.
5) Lasco.

i. Shower valves and Controls:
1) Leonard.
2) Powers.
3) Symmons.

2.2 FIXTURE SCHEDULE

A. WC-1 ADA Water Closet:
1. Wall hung with concealed carrier, vitreous china, 1.28 gpf high efficiency siphon jet action, elongated rim, top spud water closet with battery powered exposed chrome plated brass sensor activated flush valve with manual push button override.
a. Basis of Design: American Standard 3351.001.
b. Flushometer Basis of Design: Sloan Optima 111-1.28-SMO.
c. Open front seat less cover: Equal to Church 295CT.
d. Mount rim 17" above finished floor.
e. Fixture and seat finish shall be white.
f. Trim and fittings shall be chrome plated finish.
g. Floor mounted concealed chair carrier.

B. WC-2 Water Closet:
1. Wall hung with concealed carrier, vitreous china, 1.28 gpf high efficiency siphon jet action, elongated rim, top spud water closet with battery powered exposed chrome plated brass sensor activated flush valve with manual push button override.
a. Basis of Design: American Standard 3351.001.
b. Flushometer Basis of Design: Sloan Optima 111-1.28-SMO.
c. Open front seat less cover: Equal to Church 295CT.
d. Mount rim 15" above finished floor.
e. Fixture and seat finish shall be white.
f. Trim and fittings shall be chrome plated finish.
g. Floor mounted concealed chair carrier.

C. UR-1 ADA Urinal:
1. Smooth non-porous vitreous china, wall hung, wall outlet, waterfree, with sealed replaceable cartridge and biodegradable liquid sealant. Fixture shall be touch free and require no water supply. Fixture shall be white.
a. Basis of Design: Falcon F-1000 v2.
b. Wall bracket.
c. Mount rim 17" above finished floor.

D. UR-2 Urinal:

1. Smooth non-porous vitreous china, wall hung, wall outlet, waterfree, with sealed replaceable cartridge and biodegradable liquid sealant. Fixture shall be touch free and require no water supply. Fixture shall be white.
   a. Basis of Design: Falcon F-1000 v2.
   b. Wall bracket.
   c. Mount rim 24" above finished floor.

E. LAV-1 ADA Counter Lavatory:
1. Solid surface countertop with integral lavatory bowl furnished by Division 6.
2. Faucet shall be cast brass, 4" center-set, hardwire hands-free automatic operation, deck mounted spout, 0.5 gpm max. flow restrictor and aerator. Fixture shall be white. Faucet, drain, trim, and fittings shall be chrome plated finish.
   a. Lavatory: Integral with solid surface countertop by Div. 6.
   b. Faucet: Basis of Design: Sloan ETF-600, with EL 154 transformer.
   c. Grid Strainer Assembly: Sloan ETF-460-A, chrome plated brass outlet tube.
   d. Trap: 17 gauge chrome plated brass.
   e. Chrome plated supply tubing kit with chrome plated brass loose key stops.
   f. Protective apron shield furnished by Div. 6.
   g. Coordinate rough-in, connections, and mounting height with Architectural casework.

F. LAV-2 ADA Wall Hung Lavatory:
1. Wall hung, 4" centers, vitreous china, barrier free lavatory with chair carrier support. Faucet shall be cast brass, 4" center-set, hardwire hands-free automatic operation, deck mounted spout, 0.5 gpm max. flow restrictor and aerator. Fixture shall be white. Faucet, drain, trim, and fittings shall be chrome plated finish.
   a. Lavatory: Basis of Design: American Standard 0355.012.
   b. Faucet: Basis of Design: Sloan ETF-600, with EL 154 transformer.
   c. Grid Strainer Assembly: Sloan ETF-460-A, chrome plated brass outlet tube.
   d. Trap: 17 gauge chrome plated brass.
   e. Concealed arm carrier support.
   f. Chrome plated supply tubing kit with chrome plated brass loose key stops.
   g. Provide protective shielding guards on exposed piping.

G. LAV-3 ADA Under Mount Lavatory:
1. Solid surface granite countertop furnished by Division 6.
2. 18 ga. Type 304, stainless steel, undermount type, 15-1/2" x 11-3/8" x 6" deep inside bowl dimensions, faucet shall be cast brass, 4" center-set, hardwire hands-free automatic operation, deck mounted spout, 0.5 gpm max. flow restrictor and aerator. Fixture shall be white. Faucet, drain, trim, and fittings shall be chrome plated finish.
   a. Lavatory: Elkay ELU1511.
   b. Faucet: Basis of Design: Sloan ETF-600, with EL 154 transformer.
   c. Grid Strainer Assembly: Sloan ETF-460-A, chrome plated brass outlet tube.
   d. Trap: 17 gauge chrome plated brass.
   e. Chrome plated supply tubing kit with chrome plated brass loose key stops.
   f. Protective apron shield furnished by Div. 6.
   g. Coordinate rough-in, connections, and mounting height with Architectural casework.

H. SK-1 Single Bowl Under Mount Sink:
1. 18 ga. Type 304, stainless steel, under mount single bowl sink, 13-1/4" x 11-3/4" x 6" deep inside bowl dimensions, with rear center drain opening. Faucet shall be cast brass, with lever handles, deck mounted, swing spout, and 1.5 gpm max. flow aerator. Provide drain assembly with chrome plated brass basket strainer. Faucet, drain, trim, and fittings shall be chrome plated finish.

a. Sink: Basis of Design: Elkay ELU1113.
b. Faucet: Basis of Design: Chicago 786.
c. Trap and Tailpiece: 17 gauge chrome plated brass.
d. Chrome plated supply tubing kit with chrome plated brass loose key stops.
e. Protective apron shield furnished by Div. 6.
f. Coordinate rough-in, connections, and mounting height with Architectural casework.

I. SK-2 First Aid Sink:
1. 18 ga. Type 304, stainless steel, 6-1/2" deep, self-rimming, 25" x 21" single bowl sink, with punching to match faucet, and rear center drain opening. Faucet shall be cast brass, with wrist blade handles, deck mounted, swing spout, and 1.5 gpm max. flow aerator. Provide drain assembly with chrome plated brass basket strainer. Faucet, drain, trim, and fittings shall be chrome plated finish.
a. Sink: Basis of Design: Elkay LRAD2521.
b. Faucet: Basis of Design: Chicago 786.
c. Trap and Tailpiece: 17 gauge chrome plated brass.
d. Chrome plated supply tubing kit with chrome plated brass loose key stops.
e. Protective apron shield furnished by Div. 6.
f. Coordinate rough-in, connections, and mounting height with Architectural casework.

J. SK-3 Kitchen Sink:
1. 18 ga. Type 304, stainless steel, 6-1/2" deep, self-rimming, 31" x 22" single bowl sink, with punching to match faucet, and rear center drain opening. Faucet shall be cast brass, with wrist blade handles, deck mounted, swing spout, and 1.5 gpm max. flow aerator. Provide drain assembly with chrome plated brass basket strainer. Faucet, drain, trim, and fittings shall be chrome plated finish.
a. Sink: Basis of Design: Elkay LRAD3122.
b. Faucet: Basis of Design: Chicago 786.
c. Trap and Tailpiece: 17 gauge chrome plated brass.
d. Chrome plated supply tubing kit with chrome plated brass loose key stops.
e. Protective apron shield furnished by Div. 6.
f. Coordinate rough-in, connections, and mounting height with Architectural casework.

K. SH-1 ADA Shower (PH2):

L. SH-2 Shower (PH2):

M. SH-3 ADA Shower (PH2):

N. MR-1 Mop Sink:
1. Floor mounted, 24" x 24" x 10" deep, molded stone sink. Wall mounted 8" center faucet with vacuum breaker, lever blade handles, pail hook, and wall brace. Provide with accessories as indicated below. Fixture finish shall be white. Faucet, drain, trim, and fittings shall be chrome plated finish.
a. Fixture Basis of Design: Swanstone MS-2424
b. Faucet Basis of Design: Chicago 540LD-897-SWXFCP
c. Strainer: 3" stainless steel drain
d. Accessories: Mop hanger, hose and bracket, stainless steel wall guards.

O. DF-1: Drinking Fountain:
1. Bi-level, barrier free, non-refrigerated, wall mounted. Oval fountains with brushed stainless steel finish. Provide vandal resistant kit and flexible bubbler.
a. Basis of Design: Halsey Taylor OVL-II-SEBP

b. Trap: 17 gauge chrome plated brass.
c. Chrome plated supply tubing kit with chrome plated brass loose key stop.

2.3 SENSOR POWER CONVERTERS

A. Hardwired power converter (120VAC to 6VDC) to power up to 10 sensor urinal/water closet flush valves or up to 8 sensor faucets. Device shall mount to junction box.

B. Coordinate and provide quantity required for single, grouped, and gang toilet rooms. Group individual adjacent toilet rooms on a single power converter.

2.4 FIXTURE SUPPORTS

A. Water-Closet Supports:

1. Description: Combination carrier designed for accessible and standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

B. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

C. Lavatory Supports:

1. Type II, lavatory carrier with concealed arms and tie rod. Accessible-Fixture Support: Include rectangular steel uprights.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard: Manufactured plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

1. Manufacturer:

a. Trubro.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install counter-mounting fixtures in and attached to casework.

G. Install fixtures level and plumb according to roughing-in drawings.

H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

K. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

L. Install toilet seats on water closets.

M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install shower flow-control fittings with specified maximum flow rates in shower arms.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

S. Set shower receptors and service basins in leveling bed of cement grout.

T. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures and as scheduled.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets, flushometer valves, and controls. Replace damaged and or malfunctioning fixtures, valves, fittings, and controls.

B. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering during construction for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities.

END OF SECTION 224000

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following emergency plumbing fixtures:
   1. Eye/Face wash units.
   2. Drench hose units.
   3. Water-tempering equipment.

B. Related Sections include the following:

   1. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.
   2. Division 22 Section "Sanitary Waste Piping Specialties" for floor drains.

1.3 DEFINITIONS

A. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

B. Tepid: Moderately warm.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For emergency plumbing fixtures to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

B. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EYE/FACE WASH EQUIPMENT

A. Wall Mounted Eye/Face Wash Drench Hose Station , (Tagged EE-1):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Encon Safety Products.
b. Guardian Equipment Co. (Basis of Design G5046BP-DC)
c. WaterSaver Faucet Co.

2. Description: Wall mounted, exposed, eye/face wash/drench hose with two spray type outlet heads, squeeze valve, 12' coiled hose, wall bracket, and backflow preventer.

a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
b. Spray head assembly with "flip-top" individual stainless steel dust covers for each head, internal flow control valve and filter.
c. Chrome plated brass squeeze valve operator, with hands free locking clip.
d. ANSI compliant identification sign.
e. Thermostatic mixing valve.

B. Counter Mount Eye/Face Wash Drench Hose Station, (Tagged EE-2):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Encon Safety Products.
b. Guardian Equipment Co. (Basis of Design: G5022BP)
c. WaterSaver Faucet Co.

2. Description: Counter mounted, adjacent-to-sink, pull out type, eye/face wash drench hose with two spray type outlet heads, squeeze valve, 12' coiled hose, counter penetration sleeve, and backflow preventer.

a. Capacity: Deliver potable water at rate not less than 3.0 gpm for at least 15 minutes.
b. Spray head assembly with "flip-top" individual stainless steel dust covers for each head, internal flow control valve and filter.
c. Chrome plated brass squeeze valve operator, with hands free locking clip.
d. ANSI compliant identification sign.
e. Thermostatic mixing valve.

2.2 WATER-TEMPERING EQUIPMENT

A. Water-Tempering Equipment, (Tagged MV)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Encon Safety Products.
b. Guardian Equipment.
c. Haws Corporation.
d. Lawler Manufacturing Co., Inc.
e. Leonard Valve Company.

2. Performance and Capacity: As Scheduled on the Drawings.

3. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

E. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 22 Section "Common Work Results for Plumbing."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

G. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.

3.4 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities and temperatures.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Report test results in writing.

3.5 ADJUSTING

A. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeves.
4. Escutcheons.
5. Equipment installation requirements common to equipment sections.
6. Painting and finishing.
7. Concrete bases.
8. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.
2. PE: Polyethylene plastic.
3. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

a. CPVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

H. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

I. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

J. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

2.4 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.5 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

E. Split-Plate, Stamped-Steel Type: With hinge, set screw or spring clips, and chrome-plated finish.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing through accessible ceiling.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

L. Sleeves are not required for core-drilled holes.

M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

    a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

4. Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

O. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

P. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap and chain, at low points in piping system mains and elsewhere as required for system drainage.

Q. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

R. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

S. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

T. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."

U. Install unions in piping**,** NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

V. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

W. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

X. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Y. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

B. All painting of exposed utilities in finished spaces by others. Refer to Division 9 Painting Sections. Coordinate with areas as indicated on the Mechanical drawings and Architectural Reflected Ceiling and Finish Plans.

3.6 CONCRETE BASES

1. Concrete Bases: Housekeeping pads furnished and installed by others. Refer to Division 3 Concrete. Coordinate sizes and locations of housekeeping pads based on approved equipment shop drawings and submittals.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-Split Capacitor (PSC)

2. Electronically-Commutated motors (ECM)

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for HVAC system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections include the following:

1. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.
2. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.
3. Equipment supports.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Carpenter & Paterson, Inc.
3. Grinnell Corp.
4. National Pipe Hanger Corporation.
5. Piping Technology & Products, Inc.

C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Thomas & Betts Corporation.
3. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
1. Vertical Members: Two or more protective-coated-steel channels.
2. Horizontal Member: Protective-coated-steel channel.
3. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. C-Clamps (MSS Type 23): For structural shapes.
4. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick..

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Spring isolators.
3. Spring and elastomeric hangers.
4. Steel and inertia, vibration isolation equipment bases.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

A. Design Criteria:

1. Mechanical Piping and Equipment components are exempt from the requirements of ASCE 7 Chapter 13 Seismic Design for Nonstructural Components.

2. Refer to Structural General Notes Sheet S0.01.

3. Building Occupancy Category: III

4. Site Class: B

5. Seismic Design Category: A

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
2. Kinetics Noise Control.
3. Mason Industries.

B. Isolation Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern, and factory cut to sizes that match requirements of supported equipment.

1. Basis of Design: Mason Industries Super W Pads

2. Resilient Material: Oil- and water-resistant neoprene.

C. Spring Isolators: Freestanding, laterally stable, un-housed, open-spring isolators.

1. Basis of Design: Mason Industries SLFH.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of the required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.

7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Spring and Neoprene Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Basis of Design: Mason Industries 30N

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control.
3. Mason Industries.

B. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Basis of Design: Mason Industries KSL, 6” base depth.

2. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.

3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

4. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

5. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer. Coordinate with approved pump submittals.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation -control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate all vibration isolation devices with approved mechanical equipment submittals.

3.2 EXAMINATION

A. Examine areas and equipment to receive vibration isolation-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

3.4 VIBRATION-CONTROL DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 HVAC VIBRATION-CONTROL DEVICE SCHEDULE

A. Rooftop Units
   1. Curb: Vibration isolation sound attenuating curb, (specified furnished with unit).

B. Indoor Air Handling Units:
   1. Isolators: Neoprene isolation pad.

C. Air-Cooled VRF Heat Pumps:
   1. Isolators: Neoprene isolation pad.

D. Piping within 50 ft of base mounted pumps:
   1. Isolators: Spring and Elastomeric Hangers, 1" deflection.

E. Suspended, Inline Fans:
   1. Isolators: Spring and Elastomeric Hangers, 1" deflection.

F. Suspended, Indoor Evaporator Units:
   1. Isolators: Spring and Elastomeric Hangers, 1" deflection.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.
4. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.4 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

2.5 EQUIPMENT CEILING TAGS

A. Self-adhering, printed labels with removable backing.

1. Minimum 3/4” tall clear label with black printed text.
2. Ceiling tag shall include equipment's Drawing designation or unique equipment number.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Hot Water: 1-1/2 inches, round.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to equipment and other items where required.

3.6 EQUIPMENT CEILING LABEL INSTALLATION

A. Provide equipment ceiling labels on ceiling grid to locate mechanical equipment concealed above finished ceilings.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Adjusting total HVAC systems to provide indicated quantities.
3. Measuring electrical performance of HVAC equipment.
4. Setting quantitative performance of HVAC equipment.
5. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:

1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 SUBMITTALS

A. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.

1.4 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage one of the following TAB firms:

1. Maine Air Balance.
2. Central Air Balance.
3. Yankee Balancing.
4. Tab-Tech International.
5. Tekon-Technical Consultants, Inc.

B. TAB Report Forms: Use standard forms from SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" or TAB firm's forms approved by Architect.

C. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1.5 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine project record documents described in Division 1 Section "Project Record Documents."

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

E. Examine system and equipment test reports.

F. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

H. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

I. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.3 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

C. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

D. Verify that motor starters are equipped with properly sized thermal protection.

E. Check dampers for proper position to achieve desired airflow path.

F. Check for airflow blockages.

G. Check for proper sealing of air-handling unit components.

3.4 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.

B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

2. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
3. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.

C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.

D. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.

E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.5 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

3.6 PROCEDURES FOR SMOKE-CONTROL SYSTEM TESTING

A. Before testing smoke-control systems, verify that construction is complete and verify the integrity of each smoke-control zone boundary. Verify that windows and doors are closed and that applicable safing, gasket, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

B. Measure and record wind speed and direction, outside-air temperature, and relative humidity on each test day.

C. Measure, adjust, and record airflow of each smoke-control system with all fans that are a part of the system operating as intended by the design.

D. Measure, adjust, and record the airflow of each fan. For ducted systems, measure the fan airflow by duct Pitot-tube traverse.

E. After air balancing is complete, perform the following pressurization testing for each smoke control zone in the system:

1. Verify the boundaries of each smoke-control zone.
2. With the HVAC systems in their normal mode of operation and smoke control not operating, measure and record the pressure difference across each smoke-control zone. Make measurements after closing doors that separate the zones. Make one measurement across each door. Clearly indicate the high and low pressure side of each door.
3. With the system operating in the smoke-control mode and with each zone in the smoke control system activated, perform the following:

    a. Measure and record the pressure difference across each door that separates the smoke zone from adjacent zones. Make measurements with doors that separate the smoke zone from the other zones closed. Clearly indicate the high and low pressure side of the door.

Doors that have a tendency to open slightly due to the pressure difference should have one pressure measurement made while held closed and another measurement made with the door open.

b. Continue to activate each separate zoned smoke-control system and make pressure difference measurements.
c. After testing a smoke zone's smoke-control system, deactivate the HVAC systems involved and return them to their normal operating mode before activating another zone's smoke-control system.
d. Verify that controls necessary to prevent excessive pressure differences are functional.

F. Operational Tests:

1. Check the proper activation of each zoned smoke-control system in response to all means of activation, both automatic and manual.
2. Check automatic activation in response to fire alarm signals received from the building's fire alarm and detection system. Initiate a separate alarm for each means of activation to ensure that the proper operation of the correct zoned smoke-control system occurs.
3. Check and record the proper operation of fans, dampers, and related equipment as outlined below for each separate zone of the smoke-control system.

a. Fire zone in which a smoke-control system automatically activates.
b. Type of signal that activates a smoke-control system, such as pull station, sprinkler water flow, or smoke detector.
c. Smoke zone(s) where maximum mechanical exhaust to the outside is implemented and no supply air is provided.
d. Fan(s) "ON" as required to implement the smoke-control system. Multiple- or variable-speed fans should be further noted as "MAX. VOLUME" to verify that the intended control configuration is achieved.
e. Fan(s) "OFF" as required to implement the smoke-control system.
f. Damper(s) "OPEN" where maximum airflow must be achieved.
g. Damper(s) "CLOSED" where no airflow should take place.
h. Auxiliary functions to achieve the smoke-control system configuration such as changes or override of normal operating pressure and temperature-control set points.
i. If standby power is provided for the smoke-control system, test to verify that the system functions while operating under both normal and standby power.

G. Conduct additional tests required by authorities having jurisdiction. Unless required by authorities having jurisdiction, perform testing without the use of smoke or products that simulate smoke.

H. Prepare a complete report of observations, measurements, and deficiencies.

3.7 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check makeup-water-station pressure gage for adequate pressure for highest vent.

3. Check flow-control valves for specified sequence of operation and set at design flow.
4. Set system controls so automatic valves are wide open to heat exchangers.
5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.8 HYDRONIC SYSTEMS' BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Verify with the pump manufacturer that this will not damage pump. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than design flow.

1. For systems with variable frequency drives, use main balancing device for water flow measurement ONLY, obtain design water flow by setting variable frequency drive maximum frequency to achieve 0-5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of design flow rate as follows:

1. Determine the balancing station with the highest percentage over design flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems

3.11 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Airflow.
6. Air pressure drop.

3.12 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.13 PROCEDURES FOR BOILERS

A. Measure entering- and leaving-water temperatures and water flow.

3.14 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.

3.16 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Manufacturers' test data.
2. Field test reports prepared by system and equipment installers.
3. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of testing, adjusting, and balancing Agent.
3. Project name.
4. Project location.

5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of testing, adjusting, and balancing Agent who certifies the report.
10. Summary of contents, including the following:

    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer, type size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms, including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Other system operating conditions that affect performance.

E. Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.
    e. Model and serial numbers.
    f. Water flow rate in gpm.
    g. Water pressure differential in feet of head or psig.
    h. Pump rpm.
    i. Motor make and frame size.
    j. Motor horsepower and rpm.
    k. Amperage for each phase.

2. Test Data: Include design and actual values for the following:

    a. Static head in feet of head or psig.
    b. Pump shutoff pressure in feet of head or psig.
    c. Full-open flow rate in gpm.
    d. Full-open pressure in feet of head or psig.
    e. Final discharge pressure in feet of head or psig.
    f. Final suction pressure in feet of head or psig.
    g. Final total pressure in feet of head or psig.
    h. Final water flow rate in gpm.

F. Apparatus-Coil Test Reports:

1. Coil Data:

    a. System identification.

b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outside-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Entering-water temperature in deg F.
j. Leaving-water temperature in deg F.

G. Boiler Test Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.
f. Fuel type and input in Btuh.
g. Number of passes.
h. Ignition type.
i. Burner-control types.
j. Voltage at each connection.
k. Amperage for each phase.

2. Test Data (Indicated and Actual Values):

a. Operating pressure in psig.
b. Operating temperature in deg F.
c. Entering-water temperature in deg F.
d. Leaving-water temperature in deg F.
e. Number of safety valves and sizes in NPS.
f. Safety valve settings in psig.
g. High-limit setting in psig.
h. Operating-control setting.
i. High-fire set point.
j. Low-fire set point.
k. Voltage at each connection.
l. Amperage for each phase.

m. Manifold gas pressure in psig.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-to-Air Heat-Recovery Unit Reports:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and type.
e. Model and serial numbers.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full load amperage and service factor.

3. If fans are an integral part of the unit, include the following for each fan:

a. Make and type.
b. Arrangement and size.

4. Test Data (Indicated and Actual Values):

a. Total exhaust airflow rate in cfm.
b. Outside airflow rate in cfm.
c. Total exhaust fan static pressure in inches wg.
d. Total outside-air fan static pressure in inches wg.
e. Pressure drop on each side of recovery wheel in inches wg.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Flexible elastomeric.
   b. Mineral fiber.
2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied jackets.
9. Tapes.
10. Securements.

B. Related Sections:
1. Division 22 Section "Plumbing Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets.

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and

inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.

c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Owens Corning; All-Service Duct Wrap.

E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; Commercial Board.
b. Johns Manville; 800 Series Spin-Glas.
c. Knauf Insulation; Insulation Board.
d. Owens Corning; Fiberglas 700 Series.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000 Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Nelson Firestop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.

2.3 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
2. Service Temperature Range: Minus 50 to plus 180 deg F.
3. Color: White.

2.6 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED JACKETS

A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.
b. Proto PVC Corporation; LoSmoke.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

2.10 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Wire: 0.062-inch soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.

6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Pipe: Install insulation continuously through floor penetrations.
3. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

a. Do not weld anchor pins to ASME-labeled pressure vessels.

b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
d. Do not overcompress insulation during installation.
e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
f. Impale insulation over anchor pins and attach speed washers.
g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.10 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Coordinate fire-rated insulation installation with other trades. Grease ducts must be tested and accepted prior to concealing or applying insulation.

B. Install fire-rated insulation systems in strict accordance with manufacturers written installation instructions to maintain integrity of system.

C. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

D. Insulate duct access panels and doors to achieve same fire rating as duct.

E. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.11 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system as specified in Division 09 painting Sections.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.12 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply ducts.
2. Outdoor-air ducts.
3. Outdoor-air and Exhaust air plenums.
4. General Exhaust and Return ducts between isolation damper and penetration of building exterior.
5. Indoor, exposed supply ducts in Mechanical Room.

B. Items Not Insulated:
1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.

3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Indoor, concealed return ducts.
7. Indoor, concealed exhaust ducts.
8. Exposed supply and return ducts within conditioned spaces.

3.13 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Outdoor-air and Exhaust-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

D. Exhaust-air and Return-air duct insulation within 10 ft of penetration of building exterior shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

E. Indoor, exposed supply ducts in Mechanical Rooms duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

F. Kitchen (Grease) Exhaust duct insulation shall be the following:

1. Fire-Rated Blanket: Multiple layers as required by manufacturer for grease duct application to maintain zero clearance to combustibles.

3.14 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Chilled/hot water air-separator insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 1 inch thick.

C. Chilled/hot water circulation pump insulation shall be the following:

1. Flexible elastomeric: 3/4 inch thick.

3.15 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.16 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

B. Heating-Hot-Water Supply and Return, 200 Deg F and below:

1. NPS 1½" and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

2. NPS 2 and Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

C. Chilled/Hot Water Supply and Return:

1. NPS 3" and smaller: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.
b. Flexible Elastomeric: 1 inch thick.

2. NPS 4" and larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
b. Flexible Elastomeric: 1-1/2 inch thick.

D. Brine Water Supply and Return:

1. NPS 4" and larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inch thick.
b. Flexible Elastomeric: 1-1/2 inch thick.

E. All Refrigerant Piping:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 3/4 inch thick.

3.17 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Outdoor, Chilled Water Piping, aboveground:
   1. Aluminum, Stucco Embossed, with locking seam: 0.024 inch thick with silicone sealed joints.

C. Outdoor, Brine Water Piping, aboveground:
   1. Aluminum, Stucco Embossed, with locking seam: 0.024 inch thick with silicone sealed joints.

D. Piping, Exposed: PVC: 20 mils thick.
   1. All Food Service and Concession areas with exposed insulated piping at final connections to equipment.

   2. All Public Spaces with exposed insulated piping risers (to a point from finish floor up to 7' above finish floor).

END OF SECTION 230700

SECTION 230993 – SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

2. Division 23 Section “Condensing Boilers” for controls components furnished with equipment.

3. Division 23 Section “Modular Air Handling Units” for controls components furnished with equipment.

4. Division 23 Section “Packaged, Indirect-Fired, Outdoor Air Handling Units” for controls components furnished with equipment.

1.3 DEFINITIONS

A. DDC: Direct digital control.

1.4 ICE SHEET SYSTEM SEQUENCE (PH 2)

1.5 BOILER PLANT SEQUENCE (PH 2)

1.6 CHILLER PLANT SEQUENCE (PH 2)

1.7 CHANGEOVER SYSTEM DISTRIBUTION PUMP SEQUENCE (PH 2)

1.8 INDOOR AIR HANDLER SEQUENCE (PH 2)

1.9 ROOF TOP UNIT (AHU-5):

A. Constant volume air handling system shall start through DDC system provided all safeties have been satisfied.

B. Occupied: System commands supply fan to run continuously when building is occupied.

C. Fan Control: When the fan starts during the occupied mode the outside air, return air, and exhaust air dampers shall open to their minimum. Supply duct static pressure sensors shall be located per the by-pass damper manufacturer's recommendations. Zone damper terminal units modulate to maintain space temperature. Refer to terminal unit control sequences.

D. Unoccupied: The supply fan, economizer, gas heat and DX cooling shall cycle as needed to maintain unoccupied setpoints (64 deg F, heating; 78 deg F, cooling, adjustable).

E. Stop Mode: The supply fan and return fans will be off, the outside air damper will be closed, and the gas valve will be in the full closed position.

F. Smoke detection: Stop fans, and return system to STOP mode upon a signal from the fire alarm system. Wiring from the fire alarm device to the motor starters provided under Division 26. Provide status of each fan and alarm the DDC system if a fan fails to start.

G. Supply Air Temperature Control: During occupied periods system modulates economizer dampers and/or total energy wheel control (depending on unit arrangement), mechanical DX cooling, and gas control valve to maintain supply air temperature occupied setpoint (85 deg F, heating; 55 deg F, cooling, adjustable). A mixed air sensor located in the mixing box, averaging type, shall monitor the mixed air temperature. Provide supply air reset based on outside air temperature as follows:

1. At outdoor temperatures of 75 deg F or greater provide 55 deg F cooling supply air.
2. At outdoor temperatures of 60 deg F or less provide 60 deg F cooling supply air.
3. Reset cooling supply linearly between the two points.

H. Economizer: On a call for cooling, if the enthalpy of the outside air is less than the enthalpy of the return air, the energy recovery wheel (where applicable) shall be cycled to the "jog" position, outside air dampers shall be opened beyond minimum (up to 100%) to satisfy the supply air temperature setpoint. Powered exhaust fan shall cycle to maintain neutral space pressure. Mechanical DX cooling shall be locked out and off when the AHU is in economizer cooling.

I. DX Cooling: If economizer cooling is unavailable, mechanical cooling shall be energized. Cycle or stage compressors and condenser fans to satisfy cooling load and maintain space temperature.

J. Dehumidification: Cycle hot-gas reheat coil as required to dehumidify supply air and maintain space humidity setpoint of 55 deg F dew point (adjustable).

K. CO2 Sensor Operation: During occupied periods, return air duct mounted CO2 sensor shall monitor return air CO2 levels. Modulate outdoor-air damper to maintain maximum 1000-ppm concentration.

L. Bypass Damper Operation (BPD-1): Bypass damper shall provide direct bypass of supply air as required to maintain constant air flow thru air handling unit, based on system duct static pressure.

M. Control points to be provided and shown on the graphic page are as follows:

1. DDC system graphic.

2. DDC system on-off indication.
3. DDC system occupied/unoccupied mode.
4. Damper position of each damper.
5. Outdoor air temperature indication.
6. Outdoor air enthalpy indication.
7. Supply air temperature indication.
8. Supply air temperature setpoint.
9. Return air temperature indication.
10. Return air humidty setpoint.
11. Return air humidity indication.
12. Gas heat control-valve position.
13. DX cooling status.
14. DX cooling stage.
15. Economizer operation status.
16. Energy recovery wheel mode/speed.
17. Energy recovery wheel VFD Hz.
18. Energy recover wheel entering/leaving temperatures, db & wb.
19. Smoke detection alarm.
20. Supply Fan Status.
21. Supply Fan Speed.
22. Exhaust Fan Status.
23. Exhaust Fan Speed.
24. Mixed Air Temperature.
25. Bypass damper airflow.
26. Supply duct static pressure setpoint.
27. Supply duct static pressure indication.
28. CO2 setpoint.
29. CO2 indication.

1.10 GAS-FIRED MAKE UP AIR UNIT (PH 2)

1.11 ZONE DAMPER TERMINAL UNITS (ZD-X)

A. System Set Points (adjustable):

1. Heating: 68 deg F.
2. Cooling: 74 deg F.

B. Modulate zone damper terminal unit to maintain space temperature setpoint. On rise of space temperature above the cooling setpoint modulate VAV terminal unit to its maximum airflow. As space temperature drops below the cooling setpoint modulate VAV terminal unit to its minimum airflow. Upon further drop in zone temperature signal connected air handling unit for heating.

C. Control points to be provided and shown on the graphics page are as follows:

1. Space temperature setpoint
2. Space temperature
3. Supply airflow setpoint, CFM
4. Supply airflow, CFM
5. Damper position, %
6. Occupied and unoccupied status

1.12 EXHAUST FAN CONTROL SEQUENCES

A. General Toilet Room Exhaust (EF-1)

1. Exhaust fan schedule shall match facility and building zone occupancy schedule. Exhaust fan shall run continuously when in occupied mode.

2. Control points to be provided and shown on the graphic page are as follows:

a. DDC System Graphic.
b. Fan status.
c. Schedule.

B. Kitchen Grease Hood Exhaust (EF-2)

1. Hoods specified furnished with factory mounted integral controls package. Refer to Division 11 for components.

2. Constant volume exhaust fan serving grease hood. Exhaust fan and hood lights shall be manually switched “On/Off” locally at hood utility/control cabinet. If fan fails to start, an alarm shall be displayed.

3. Control points to be provided and shown on the graphic page are as follows:

a. DDC system graphic.
b. Fan on-off indication.
c. Alarm status.

1.13 SMOKE CONTROL SYSTEM SEQUENCE OF OPERATION (SEF-3)

A. Smoke Control Mode: The DDC controller receives a smoke present signal from the Fire Alarm System the unit shall enter the Smoke Control Mode of operation. Activation of this mode whether automatically or manually, shall stop the associated air handling unit exhaust or return fan, close the unit exhaust air stream damper, start the smoke exhaust fans (tagged SEF) and bypass the air handling unit safeties. Airflow at the smoke exhaust fan shall be monitored and proven by a sail type switch located in the smoke exhaust ductwork. The smoke exhaust fan shall continue to operate until the smoke present signal is no longer received from the Fire Alarm System. When a smoke present signal is no longer being received from the Fire Alarm System, the smoke exhaust fan shall be deactivated, and the associated air handling unit shall enter the Normal mode of operation. The DDC System controller and all associated components shall be U.L. Listed as required for Smoke Control Systems to support the Life Safety functions.

1.14 I.T. ROOMS – AIR CONDITIONING SEQUENCE (EVU-1, ACCU-1)

A. System Set Points(adjustable):

1. Cooling: 78 deg F.

B. Indoor evaporator unit and outdoor condensing unit shall be provided with self contained controls (by equip. manufacturer).

C. Provide space sensor for monitoring of IT room temperature through the building controls system. Provide alarm condition when space temperature rises 2 deg F (adjustable) above space sensor set-point.

D. Control points to be provided and shown on the graphic page are as follows:

1. DDC System Graphic
2. Space temperature setpoint.
3. Space temperature measured.
4. Alarm for high temperature setpoint.

1.15 PLUMBING EQUIPMENT CONTROL AND MONITORING SEQUENCES

A. Elevator Sump Pump (SP-1):

1. Provide alarm points to monitor the sump pump.
2. Control points to be provided and shown on the graphic page are as follows:
   a. Alarm Status.
   b. Pump Status.

B. Domestic Hot Water: (PH 2)

C. Domestic Hot Water Recirculation Pump: (PH 2)

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1. Static-Pressure Classes:
   a. Indoor Air Handlers:
      1) ALL Outside, Supply, Return and Exhaust: 2-inch wg.
   b. Rooftop Air Handlers:
      1) Return air ducts: 2-inch wg.
      2) Supply Ducts (between AHU and terminal units): 2-inch wg.
      3) Supply Ducts (downstream of terminal units): 1-inch wg.
   c. Indoor Evaporator units:
      1) Supply and Return: 1-inch wg.
   d. General Exhaust Ducts (negative pressure): 1-inch wg.
   e. General Exhaust Ducts (positive pressure): 2-inch wg.

2. Kitchen Exhaust Systems:
   a. Liquid tight per IMC 2006 and NFPA 96.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Duct materials.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Fittings.
4. Reinforcement and spacing.
5. Seam and joint construction.
6. Penetrations through fire-rated and other partitions.
7. Equipment installation based on equipment being used on Project.
8. Duct accessories, including dampers, turning vanes, and access doors and panels.
9. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Field quality-control reports.

1. Kitchen exhaust system leak test reports.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View for Field painting: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304; cold rolled, annealed, sheet. Surface finish shall be No. 4.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

C. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install kitchen exhaust ducts according to NFPA 96.

D. Install round ducts in maximum practical lengths.

E. Install ducts with fewest possible joints.

F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

K. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

1. For static-pressure classes 1inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C.

2. For static-pressure classes 2 inch wg, and above comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A, all traverse joints, all longitudinal seams, and all duct wall penetrations.

3. For positive pressure exhaust ducts, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class A, all traverse joints, all longitudinal seams, and all duct wall penetrations.

4. Install sealant materials in strict accordance with manufacturer’s surface preparation and installation instructions.

5. Exposed un-insulated ducts: Apply sealant NEATLY. Caulking and finish painting of exposed ductwork is specified in Division 7 and Division 9.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.5 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.6 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as follows:

1. Kitchen hood grease exhaust ducts; 16 gauge welded carbon steel with continuous liquid-tight welded joints. Provide gasketed steel welded and/or bolted access panels at each change in direction.
2. Dishwasher hood condensate exhaust ducts; 16 gauge welded 304 stainless steel with continuous liquid-tight welded joints.

B. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts: Stainless steel.

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

   b. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

      1) 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Conical, bellmouth.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals."

   a. 45-degree lateral.

3.7 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections prior to concealing or placing into service.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual.", NFPA 96, and IMC 2006. Submit a test report for each test.

2. Test the following systems:
   a. Kitchen exhaust duct systems.

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Remote damper operators.
4. Fire dampers.
5. Turning vanes.
6. Duct-mounting access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

B. Related Sections include the following:

1. Division 23 Section "HVAC Instrumentation and Controls" for electric damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Volume dampers.
2. Motorized control dampers.
3. Fire dampers.
4. Duct-mounting access doors.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. American Warming and Ventilating; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Nailor Industries Inc.
5. Ruskin Company.

B. Description: Adjustable, gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:

1. Material: Galvanized steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.

N. Sleeve: Minimum 20-gage thickness.

2.3 VOLUME DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Penn Ventilation Company, Inc.
6. Ruskin Company.
7. Vent Products Company, Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Oil-impregnated bronze.
5. Tie Bars and Brackets: Galvanized steel.

D. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 MOTORIZED CONTROL DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. METALAIRE, Inc.
7. Nailor Industries Inc.
8. Penn Ventilation Company, Inc.
9. Ruskin Company.

10. Vent Products Company, Inc.

B. General Description: AMCA-rated, opposed-blade design; minimum of 0.1084-inch- thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick, galvanized-steel damper blades with maximum blade width of 8 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Provide closed-cell neoprene edging.

2.5 FIRE DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. CESCO Products.
3. Greenheck.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Penn Ventilation Company, Inc.
7. Ruskin Company.
8. Vent Products Company, Inc.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 hours.

D. Frame: Curtain type with blades outside the airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 2-inch- wide, single-vane, curved blades of galvanized sheet steel set 2 inches o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting. For duct widths 36" and larger utilize 4-inch wide, single-vane, curved blades set at 4 inches on center.

1. Available Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.

2.7 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Available Manufacturers:

a. American Warming and Ventilating.
b. CESCO Products.
c. Ductmate Industries, Inc.
d. Greenheck.
e. Nailor Industries Inc.
f. Ventfabrics, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

a. Less Than 12 Inches Square: Secure with two sash locks.
b. Up to 18 Inches Square: Two hinges and two sash locks.
c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

D. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. Available Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.9 FLEXIBLE DUCTS

A. Available Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.

B. Insulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Minimum insulation: Minimum R-value of 4.2.

C. Flexible Duct Clamps: Nylon strap, in sizes 3 through 18 inches to suit duct size.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

D. Install fire dampers, with fusible links, according to manufacturer's UL-approved written instructions.

E. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

F. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 8 inches.
2. Two-Hand Access: 12 by 12 inches.

G. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

H. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

I. Connect diffusers to low-pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

J. Connect flexible ducts to metal ducts with adhesive and draw bands.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.
2. Ceiling-mounted ventilators.
3. Smoke exhaust propeller fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.

D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards:

1. Power ventilators shall comply with UL 705.
2. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.
3. Power ventilators for use for smoke exhaust shall also comply with UL "Power Ventilator for Smoke Control".

1.6 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Captive-aire.
2. Greenheck Fan Corporation.
3. Loren Cook Company.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Downblast Units: Provide spun-aluminum discharge baffle to direct discharge air downward.

2. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector (as scheduled).
3. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance (as scheduled).

B. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

C. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

D. Accessories: As Scheduled on the Drawings.

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside or outside fan housing, factory wired through an internal aluminum conduit.
3. Belt Tensioner: Maintain constant belt tension to resist premature belt wear.
4. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
6. Coated, non-stick fan wheels for kitchen exhaust applications.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 24 inches.
3. Pitch Mounting: Manufacture curb for roof slope.
4. Vented Curb extensions: Unlined with louvered vents in vertical sides.

F. Capacities and Characteristics: As Scheduled on the Drawings.

2.3 IN-LINE CENTRIFUGAL FANS

A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

C. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

E. Accessories: As Scheduled on the Drawings.

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
5. Vibration Isolators: Type: Spring and elastomeric hangers.

F. Capacities and Characteristics: As Scheduled on the Drawings.

2.4 CEILING-MOUNTED VENTILATORS

A. Housing: Steel, lined with acoustical insulation.

B. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

C. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

D. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

E. Accessories: As Scheduled on the Drawings.

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Isolation: Rubber-in-shear vibration isolators.
4. Manufacturer's standard wall cap, and transition fittings.

F. Capacities and Characteristics: As Scheduled on the Drawings.

2.5 SMOKE EXHUAST PROPELLER FANS

A. Description: Fan shall be UL listed as "Power Ventilator for Smoke Control Systems". Fan shall be belt driven, upblast propeller type.

1. Basis of Design: Greenheck TUBSC.

B. Construction: Heavy gauge painted steel, integral spun venturi inlet with reinforced welded steel curb cap.

C. Dampers: The top of the lower housing shall be covered with butterfly dampers to produce a weather tight seal over the propeller. The windband shall be rolled and continuously welded with flanges for on each end for stiffness. The fan shall be fitted with heavy-duty spring-loaded, damper actuator arms to open automatically when the airstream reaches 165 degrees F. Damper actuators shall meet the requirements of UL 793 for Snow Load Testing of Butterfly Dampers (l0 lb per sqft). The unit shall be tested to meet minimum 500 degree F for a minimum of 4 hours and 1000 degrees F for a minimum of 15 minutes. The dampers shall operate with or without electrical power connected to the fan.

D. Fan Wheel: Propeller shall be all steel construction welded or riveted to heavy-duty hub. Propeller shall be statically and dynamically balanced.

E. Belt-Drive Assembly: The motor shall be out of the airstream under a removable cover. The belts shall be protected from the airstream.
   1. Service Factor Based on Fan Motor: 150%.
   2. Fan Shaft: Turned, ground, and polished steel, keyed to wheel hub. Include shaft cooler.
   3. Shaft Bearings: Pillow block ball bearings, with extended lube lines.
   4. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
   5. Motor Pulleys:
      a. Adjustable pitch for use with motors through 5 hp.
      b. Fixed pitch for use with motors larger than 5 hp.
      c. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
   6. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
   7. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Capacities and Characteristics: As Scheduled on the Drawings.

2.6 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Enclosure Type: Totally enclosed, fan cooled.

2.7 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Install kitchen exhaust fans and systems according to NFPA 96.

C. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

D. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Division 07 Section "Roof Accessories" for installation of roof curbs.

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1.4 SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.

B. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.1 CHANGEOVER, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek Company.
2. Environmental Technologies, Inc.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Price Industries.
6. Titus.
7. Trane; a business of American Standard Companies. (Basis of design: Varitrac)

B. Performance: As Scheduled on the Drawings.

C. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

D. Casing: 0.034-inch steel, single wall.
1. Casing Lining: Adhesive attached, 1/2-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

a. Cover liner with nonporous foil.

2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Direct Digital Controls: Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation and Control for HVAC."

2.2 BYPASS TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anemostat Products; a Mestek Company.
2. Environmental Technologies, Inc.
3. METALAIRE, Inc.
4. Nailor Industries Inc.
5. Price Industries.
6. Titus.
7. Trane; a business of American Standard Companies. (Basis of design: Varitrac)

B. Performance: As Scheduled on the Drawings.

C. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud. Operation based on supply duct static pressure.

D. Casing: 0.034-inch steel, single wall.
1. Casing Lining: Adhesive attached, 1/2-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

a. Cover liner with nonporous foil.

2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Direct Digital Controls: Single-package unitary controller and actuator specified in Division 23 Section "Instrumentation and Control for HVAC." Bypass damper controls and sensors shall be supplied by the bypass damper manufacturer.

2.3 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

C. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 CONNECTIONS

A. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts" and as detailed on the Drawings.

3.4 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
   3. Verify that controls and control enclosure are accessible.
   4. Verify that control connections are complete.
   5. Verify that nameplate and identification tag are visible.
   6. Verify that controls respond to inputs as specified.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 23 Section "Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

C. Performance as indicated and scheduled in the Drawings.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS

A. Available Manufacturers: Subject to compliance with requirements, provide scheduled units by the Basis of Design manufacturer, Price Industries, or equal by one of the following:

1. Anemostat, a Mestek company.
2. Metalaire, by Metal Industries, Inc.

3. Price Industries
4. Titus

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237423.16 - PACKAGED, INDIRECT-FIRED, OUTDOOR, AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes indirect-fired makeup-air units.

1.3 DEFINITIONS

A. BAS: Building automation system.

1.4 SUBMITTALS

A. Product Data: For each type and configuration of outdoor, indirect-fired makeup-air unit.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each type and configuration of outdoor, indirect-fired heating and ventilating unit.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
5. Include diagrams for power, signal, and control wiring.

C. Startup service reports.

D. Sample Warranty: For manufacturer's special warranty.

E. Seismic Qualification Certificates: Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for outdoor, indirect-fired makeup-air units, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Operation and Maintenance Data: For indirect-fired makeup-air units to include in emergency, operation, and maintenance manuals.

1.5 ADDITIONAL MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each unit.
2. Fan Belts: One set(s) for each unit.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of indirect-fired heating and ventilating units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Stainless Steel Heat Exchangers: Manufacturer's standard, but not less than ten (10) years from date of Substantial Completion.
2. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. McQuay International.
3. Reznor/Thomas & Betts Corporation.
4. Sterling HVAC Products.
5. Trane Inc. (Basis of Design)

2.2 SYSTEM DESCRIPTION

A. Factory-assembled, prewired, self-contained unit consisting of cabinet, supply fan, condenser, compressors, controls, filters, and indirect-fired gas burner to be installed exterior to the building.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Casing Joints: Sheet metal screws or pop rivets, factory sealed with water-resistant sealant.
2. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.
3. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Configuration: Packaged unit with bottom discharge for roof-mounting installation.

C. Casing Construction: Galvanized-steel outer wall with baked-enamel finish, foamed in place 2” insulation with galvanized steel inner liner.

D. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:

a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.

E. Condensate Drain Pans:

1. Fabricated with slope in at least two planes to collect condensate from condensate-producing heat exchangers and to direct water toward drain connection.
2. Single-wall, stainless-steel sheet.
3. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

2.4 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard hood or louver.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.5 SUPPLY-AIR FAN

A. Fan Type: Centrifugal, backward-incline, airfoil blades, rated according to AMCA 210; statically and dynamically balanced.

B. Drive: Belt drive, adjustable sheaves, and adjustable motor mount for belt tensioning.

C. Mounting: Fan wheel, motor, and drives shall be mounted to common frame on spring isolators.

2.6 AIR FILTERS

A. Disposable Panel Filters: Factory-fabricated, pleated, disposable air filters with beverage-board support frames.

1. Thickness: 2 inches.
2. MERV rating according to ASHRAE 52.2 as scheduled on the Drawings.

2.7 DAMPERS

A. Outdoor-Air and Return-Air Dampers: Galvanized-steel, opposed-blade dampers with vinyl blade seals and stainless-steel jamb seals, having a maximum leakage of 10 cfm/sq. ft. of damper area, at a differential pressure of 2-inch wg.

B. Damper Operator: Direct coupled, electronic with spring return or fully modulating as required by the control sequence.

2.8 INDIRECT-FIRED GAS BURNER

A. Description: Factory assembled, piped, and wired; and complying with ANSI Z21.47, "Gas-Fired Central Furnaces," and with NFPA 54, "National Fuel Gas Code."

1. CSA Approval: Designed and certified by and bearing label of CSA.
2. Burners: Stainless steel.

a. Gas Control Valve: on/off.
b. Fuel: Natural gas.
c. Ignition: Electronically controlled electric spark with flame sensor.

B. Venting: Power vented, with integral, motorized centrifugal fan interlocked with gas valve.

C. Combustion-Air Intake: Separate combustion-air intake and vent terminal assembly.

D. Heat Exchanger: Tubular, Stainless steel.

E. Heat-Exchanger Drain Pan: Stainless steel.

F. Safety Controls:

1. Control Transformer: 24-V ac.
2. Gas Train: Regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, electronic-modulating temperature control valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
3. Purge-period timer shall automatically delay burner ignition and bypass low-limit control.
4. Airflow Proving Switch: Differential pressure switch senses correct airflow before energizing pilot.
5. Automatic-Reset, High-Limit Control Device: Stops burner and closes main gas valve if high-limit temperature is exceeded.
6. Safety Lockout Switch: Locks out ignition sequence if burner fails to light after three tries. Controls are reset manually by turning the unit off and on.

2.9 ENERGY RECOVERY WHEEL

A. Rotating wheel assembly consisting of wheel, cassette frame, seals, drive motor and drive belt.

B. Wheel Construction: Polymer base with silica gel desiccant.

C. Wheel housing shall include air filters on the exhaust air and outdoor air entering the wheel.

1. Filter performance shall be as scheduled on the Drawings.

2.10 POWERED EXHAUST FAN

A. Fan Type: Centrifugal, backward-incline, airfoil blades, rated according to AMCA 210; statically and dynamically balanced.

B. Drive: Direct drive, fan directly mounted to motor shaft.

C. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with restrained, spring isolators.

2.11 DIRECT EXPANSION COOLING

A. Unit shall be provided with packaged direct expansion cooling system consisting of air-cooled condensing unit, evaporator coil and controls.

B. Condensing unit:

1. Coil shall be multi-row, internally finned, copper tubes mechanically bonded to aluminum fins. Coils shall be leak and pressure tested to 500 psig.
2. Fans shall be aluminum axial-type, direct drive, directly coupled to motor. Fan shall be statically and dynamically balanced. Fans shall discharge vertically.

3. Units 7.5 tons and larger shall contain two (2) constant speed scroll compressors to provide higher cooling efficiencies. Units smaller than 7.5 tons shall have a single constant volume scroll compressor.
4. Each compressor shall be protected by an electric crankcase heater.
5. Refrigerant: R-410a.

C. Evaporator Coil:

1. Coil shall be multi-row, internally finned, copper tubes mechanically bonded to aluminum fins. Coils shall be leak and pressure tested to 500 psig.
2. Coils on units 7.5 tons and larger shall have two (2) refrigerant circuits with an interlaced circuiting, and an electronic expansion valve per circuit.
3. All refrigeration piping shall be factory assembled, insulated and tested.

D. Reheat Coil:

1. A reheat coil shall be placed downstream of the evaporator coil for the purpose of dehumidifying the air.
2. Coil shall be multi-row, internally finned, copper tubes mechanically bonded to aluminum fins. Coils shall be leak and pressure tested to 500 psig.
3. Hot Gas from the refrigerant circuit shall supply the reheat coil.

2.12 ROOF CURBS

A. Roof curb with vibration isolators and seismic restraints.

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

a. Materials: ASTM C 1071, Type I or Type II.
b. Thickness: 1-1/2 inches.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

C. Curb Height: 24 inches.

1. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match unit, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

2.13 ACCESSORIES

A. As scheduled on the Drawings.

2.14 UNIT CONTROL PANEL

A. Factory-wired, fuse-protected control transformer, connection for power supply and field-wired unit to remote control panel.

B. Control Panel: Surface-mounted remote panel, with engraved steel cover and the following lights and switches:

1. BAS interface controller for monitoring, setting, editing, controlling, and display of alarms though the buildings DDC system.
2. Supply-fan operation indicator.
3. Heating operation indicator.
4. Damper position potentiometer.
5. Dirty-filter indicator operated by unit-mounted differential pressure switch.
6. Safety-lockout indicator.
7. Enclosure: NEMA 250, Type 3R.

2.15 CONTROLS

A. Comply with requirements in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence of Operations for HVAC Controls" for control equipment and sequence of operation.

B. Control Devices:
1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
2. Discharge Air Temperature Sensor.
3. Return Air Temperature and Humidity Sensor.
4. Outdoor Air Temperature and Humidity Sensor.
5. Anti-short cycling timer.
6. Timers: Seven-day, programming-switch timer with synchronous-timing motor and seven-day dial; continuously charged, nickel-cadmium-battery-driven, eight-hour, power-failure carryover; multiple-switch trippers; minimum of two and maximum of eight signals per day with two normally open and two normally closed output contacts.
7. Ionization-Type Smoke Detectors: 24-V dc, nominal; self-restoring; plug-in arrangement; integral visual-indicating light; sensitivity that can be tested and adjusted in place after installation; integral addressable module; remote controllability; responsive to both visible and invisible products of combustion; self-compensating for changes in environmental conditions.

C. Fan Control: Timer starts and stops indirect-fired heating and ventilating unit and exhaust fan(s).

1. Smoke detectors, located in supply air, shall stop fans when the presence of smoke is detected.

D. Outdoor-Air Damper Control, 100 Percent Outdoor-Air Units: Outdoor-air damper shall open when supply fan starts, and close when fan stops.

E. Temperature Control: Operates gas valve to maintain supply-air temperature.

1. Operates gas valve to maintain discharge-air temperature with factory-mounted sensor in blower outlet.
2. Burner Control: On/off control.

2.16 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Enclosure: Totally enclosed, fan cooled.
2. Efficiency: Premium efficient.

2.17 CAPACITIES AND CHARACTERISTICS

A. For performance and capacities shall be as scheduled in the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Verify cleanliness of airflow path to include inner-casing surfaces, filters, coils, turning vanes, fan wheels, and other components.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting:

1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."

C. Roof Curb: Install on roof structure or concrete base, level and secure. Install units on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure units to upper curb rail, and secure curb base to roof framing with anchor bolts.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

1. Gas Piping: Comply with requirements in Section 221123 "Facility Natural Gas Piping." Connect gas piping with shutoff valve and union, and with sufficient clearance for burner removal and service. Make final connections of gas piping to unit with corrugated, stainless-steel tubing flexible connectors complying with ANSI LC 1/CSA 6.26 equipment connections.

B. Drain: Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for traps and accessories on piping connections to condensate drain pans under condensing heat exchangers. Where installing piping adjacent to heating and ventilating units, allow space for service and maintenance.

C. Duct Connections: Connect supply and return ducts to indirect-fired heating and ventilating units with flexible duct connectors. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Units will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for visible damage to burner combustion chamber.
2. Inspect casing insulation for integrity, moisture content, and adhesion.
3. Verify that clearances have been provided for servicing.
4. Verify that controls are connected and operable.
5. Verify that filters are installed.
6. Purge gas line.
7. Inspect and adjust vibration isolators and seismic restraints.
8. Verify bearing lubrication.
9. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.

C. Start unit according to manufacturer's written instructions.

1. Complete startup sheets and attach copy with Contractor's startup report.
2. Inspect and record performance of interlocks and protective devices; verify sequences.
3. Operate unit for run-in period recommended by manufacturer.

4. Perform the following operations for both minimum and maximum firing, and adjust burner for peak efficiency:

    a. Measure gas pressure at manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

5. Calibrate thermostats.
6. Adjust and inspect high-temperature limits.
7. Inspect dampers, if any, for proper stroke and interlock with return-air dampers.
8. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
9. Measure and record airflow. Plot fan volumes on fan curve.
10. Verify operation of remote panel, including pilot-operation and failure modes. Inspect the following:

    a. High-limit heat.
    b. Alarms.

11. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.
12. Verify drain-pan performance.
13. Verify outdoor-air damper operation.
14. Inspect condenser fans for proper rotation and binding.
15. Verify proper operation of condenser capacity control device and staging of compressors.
16. Verify refrigerant volume and pressure match manufacturer’s literature.

3.6 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 6 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heating and ventilating units.

END OF SECTION 237423.16

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 ,Type XHHW-2 and Type SO.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC mineral-insulated, metal-sheathed cable, Type MI and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway Metal-clad cable, Type MC and Mineral-insulated, metal-sheathed cable, Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Metal-clad cable, Type MC.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway Metal-clad cable, Type MC.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

1. Unclosed cables may be exposed only in unfinished areas and within existing trenches.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) near the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
2. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and IMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and IMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To New Concrete: Bolt to concrete inserts.
2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
3. To Existing Concrete: Expansion anchor fasteners.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
5. To Steel: Spring-tension clamps.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

A. IMC: Intermediate metal conduit.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. IMC: Comply with ANSI C80.6 and UL 1242.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew or compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

E. Joint Compound for IMC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. LFNC: Comply with UL 1660.

D. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: Comply with UL 514B.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Screw-cover type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

I. Gangable boxes are allowed.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: RNC, Type EPC-40-PVC.
2. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: IMC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only in unfinished areas and within the existing trenches.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inchesof enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT or IMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.

2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross between the existing and new building.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Y. Horizontally separate boxes mounted on opposite sides of walls so they are not back-to-back. Devices may be installed in the same vertical channel.

Z. Locate boxes so that cover or plate will not span different building finishes.

AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Conduit, ducts, and duct accessories for concrete-encased duct banks, and direct-buried, single duct runs.
2. Manholes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Comply with IEEE C2.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 COORDINATION

A. Coordinate layout and installation of ducts, manholes and handholes with final arrangement of other utilities, site grading, and surface features as determined in the field.

PART 2 - PRODUCTS

2.1 CONDUIT

A. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 PRECAST MANHOLES AND TRANSFORMER VAULTS

A. Comply with ASTM C 858, with structural design loading as specified in "Underground Enclosure Application" Article, and with interlocking mating sections, complete with accessories, hardware, and features.

1. Duct Entrances in Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a. Type and size shall match fittings to duct or conduit to be terminated.
b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

B. Concrete Knockout Panels: 1-1/2 to 2 inches thick, unless noted otherwise, for future conduit entrance and sleeve for ground rod.

2.3 UTILITY STRUCTURE ACCESSORIES

A. Ferrous metal hardware, where indicated, shall be hot-dip galvanized complying with ASTM A 153 and A 123.

B. Manhole Frames and Covers: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.

a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

2. Cover Legend: Cast in. Retained to suit system.

a. Legend: "CMP Co." for duct systems with primary electrical service cables.
b. Legend: "CABLE" for cable television service duct systems.
c. Legend: "TELEPHONE" for telephone duct systems.

C. Transformer Vault Access Doors:

1. Frame: ¼" Aluminum channel with recessed anchors and support shelf.

a. Type 316 stainless steel hardware.

2. Doors: Aluminum with diamond milled finish.

D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-diameter eye, and 1-by-4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of

300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank.

B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank unless otherwise indicated.

C. Underground Ducts for Telephone or Cable Television Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank unless otherwise indicated.

3.2 UNDERGROUND ENCLOSURE APPLICATION

A. Manholes and Electrical Vaults: Precast concrete.

1. Units Located in Roadways, Sidewalks and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

3.3 DUCT INSTALLATION

A. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 12.5 ft., both horizontally and vertically, at other locations unless otherwise indicated.

B. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

C. Duct Entrances to Manholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 ft. from the end bell without reducing duct line slope and without forming a trap in the line.
2. Grout end bells into structure walls from both sides to provide watertight entrances.

D. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

E. Pulling Cord: Install 100-lbf-test nylon cord in ducts, including spares.

F. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 ft. of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers.

Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concreting shall be performed by Division 31 Contractor.
3. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
4. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services.
5. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

G. Direct-Buried Duct Banks:

1. Install manufactured duct elbows for stub-ups at poles and equipment unless otherwise indicated.
2. Warning Tape Bury warning tape approximately 12 inches above all direct-buried ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank.

3.4 INSTALLATION OF CONCRETE MANHOLES AND ELECTRICAL VAULTS

A. Precast Concrete Structure Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Covers: Set manhole covers flush with finished grade.

C. Manhole Access: Circular opening in manhole roof; sized to match cover size.

D. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Waterproofing materials and installation are noted on the Drawings. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

F. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

G. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

    a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification for conductors.
3. Warning labels and signs.
4. Equipment identification labels.
5. Miscellaneous identification products.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.4 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Arc Flash Warning: “DANGER – ARC FLASH HAZARD –Follow requirements in NFPA 70E for safe work practices and appropriate PPE. Failure to comply can result in death or injury.”

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Self-adhesive, Engraved, Laminated Acrylic or Melamine Label: adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces above accessible ceilings: Plenum rated.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

B. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

C. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

5. Apply arc flash warning labels to door or cover of all panelboards.
6. Apply workspace clearance warning labels to door or cover of all panelboards and control panels located in finished spaces that do not receive floor marking tape.

E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
    b. Enclosures and electrical cabinets.
    c. Access doors and panels for concealed electrical items.
    d. Switchgear.
    e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    f. Emergency system boxes and enclosures.
    g. Enclosed switches.
    h. Enclosed circuit breakers.
    i. Enclosed controllers.
    j. Power transfer equipment.

k. Contactors.
l. Remote-controlled switches, dimmer modules, and control devices.
m. Power-generating units.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Indoor occupancy sensors.
2. Vacancy sensors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Building Automation, Inc.
2. Leviton Mfg. Company Inc.
3. Lightolier Controls.
4. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 5 to 30 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.

C. Dual-Technology Type: Detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.2 VACANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hubbell Building Automation, Inc.
2. Leviton Mfg. Company Inc.
3. Lightolier Controls.
4. Watt Stopper.

A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V.

B. Single Relay Wall-Switch Sensor:

1. Standard Range: 180-degree field of view; with a minimum coverage area of 225 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, manual "on," automatic "off."
4. Voltage: Dual voltage, 120 and 277 V; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.

C. Dual Relay Wall-Switch Sensor:

1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 225 sq. ft.
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: Each switch shall be SP, manual "on," automatic "off."
4. Voltage: Dual voltage, 120 and 277 V; dual-technology type.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor. Each switch may be programmed for a different lighting level.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.

2.3 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and vacancy sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

3.6 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260933 "Architectural Dimming Controls."

B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 260933 - ARCHITECTURAL DIMMING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. The Theatrical Contractor, as part of the work of this section, shall provide, install and test a complete lighting control system as specified herein for areas indicated on the drawings and circuit schedules.

B. The Theatrical Contractor shall be responsible for all low voltage terminations related to the equipment listed in this section.

C. The Electrical Contractor shall be responsible for all line voltage terminations.

D. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware and other incidental item necessary for the complete and proper operation of the lighting control system.

E. Both Electrical Contractor and Theatrical Contractor shall coordinate all work described in this section with all other applicable plans and specifications.

F. Matrix of Responsibilities:

Item	Electrical Contractor		Theatrical Contractor	
	Furnish	Install	Furnish	Install
All High Voltage Wire	X	X		
Low Voltage wire for equipment included in this section		X	X	
All Conduit, raceways, and interconnecting boxes	X	X		
High Voltage wire testing and labeling	X	X		
Junction Boxes	X	X		
Standard Back boxes	X	X		
Specialty Back Boxes		X	X	
High Voltage Terminations	X	X		
Low Voltage Terminations			X	X
Dimmer Racks/Cabinets		X	X	
Theatrical Control Devices			X	X
Theatrical Circuit Distribution Race ways			X	X

1.3 SUMMARY

A. Section includes factory pre-wired dimming and processing rack enclosures for control of architectural lighting. System shall be designed to include dimmers, relays, power supplies, breakers, terminals and/or control electronics.

B. System shall work in conjunction with specified low-voltage control stations and devices.

C. System shall contain emergency bypass unit for specified circuits.

D. Related Requirements:

1. Division 26 Section "Low-Voltage Conductors and Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems rated 600V and less.
2. Division 26 Section "Raceways and Boxes for Electrical Systems" for conduits, wireways, boxes and enclousures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Shop Drawings should include:
1. Full system riser diagram(s) illustrating interconnection of system components, wiring requirements, back box sizes and any special installation considerations.
2. Detailed set of dimmer schedules.
3. Detailed set of circuit and control schedules, including a complete list of all deviations from specifications.

C. Manufacturer shall provide any additional information, including equipment demonstrations, as required by the engineer to verify compliance with specifications.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For architectural dimming controls to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

a. Software manuals.
b. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
c. Testing and adjusting of panic and emergency power features.

1.6 QUALITY ASSURANCE

A. Architectural dimming system must be designed and installed by a single qualified firm, referred to as the Theatrical Contractor.

B. Manufacturer shall be one who has been continuously engaged in the manufacturer of lighting control equipment for a minimum of ten years. All dimmer and cabinet fabrication must take place in a U.S. manufacturing plant.

C. The manufacturer shall have a factory authorized stocking service center with at least one full time service technician on staff located within 300 miles of the job site. In addition, the manufacturer shall have a toll free 24-hour hotline with a maximum response time of 20 minutes, 24 hours a day and 365 days a year.

D. All equipment, where applicable standards have been established, shall be built to the standards of Underwriters Laboratories, Inc., the National Electric Code and the United States Institute for Theater Technology. Permanently installed power distribution equipment such as dimmer racks and distribution shall be UL and C-UL Listed, and/or CE marked (where applicable) and bear the appropriate labels. Portable equipment such as consoles and fixtures shall be UL and C-UL Listed, ETL Listed and/or CE marked (where applicable) and bear the appropriate labels.

E. Theatrical Contractor Qualifications: Theatrical Contractor must met the following requirements:

1. have an Entertainment Technician Certification Program (ETCP) Certified Electrician on staff.
2. have a 24 hour emergency contact number or pager service for off hour emergencies.

1.7 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two years from date of delivery.

B. Warranty shall cover repair or replacement of such parts determined defective upon inspection.

C. Warranty does not cover any product or part of a product subject to accident, negligence, alteration, abuse or misuse. Warranty does not cover any accessories or parts not supplied by the manufacturer.

D. Warranty shall not cover any labor expended or materials used to repair any equipment without manufacturer's prior written authorization.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Electronic Theatre Controls, Inc to match existing lighting control system.

2.2 GENERAL SYSTEM REQUIREMENTS

A. Compatibility:

1. Dimming control components shall be compatible with lighting fixtures, ballasts, and transformers.
2. Dimming control devices shall be compatible with lighting control system components specified in Section 26 09 23 "Lighting Control Devices."

2.3 DIMMER MODULES

A. General

1. The dimmer modules shall be the Sensor dimmer modules as manufactured by Electronic Theatre Controls, Inc., or equal. Sensor dimmer modules shall be for use with Unison dimming racks.
2. Dimmer Modules shall consist of a heavy-duty, die-cast aluminum chassis with an integral faceplate. All parts shall be properly treated, primed and finished in fine-texture, scratch-resistant gray epoxy powder coat.
3. With the exception of the circuit breaker, the module shall contain no moving parts.
4. Each module shall be labeled with the manufacturer's name, catalog number and rating.
5. All electronic components (current/voltage sensors and indicators) shall be contained in a single field-replaceable housing.

B. Electrical

1. Each dimmer module shall contain two single-pole circuit breakers, a solid-state switching module, associated toroidal filters, and power and control connectors.
2. Modules shall not have any protruding pins subject to physical damage when the module is not installed.
3. Modules shall be keyed so that dimmer modules of different capacity shall not be interchangeable.
4. Circuit breakers shall be fully magnetic so the trip current is not affected by ambient temperature. Circuit breakers shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current. Circuit breakers shall be rated for 100 percent switching duty applications. Dimmers that do not operate continuously at 100% load shall not be acceptable.

C. SCR Assembly

1. Each dimmer module shall use a solid state module (SSM) consisting of two silicon-controlled rectifiers (SCRs) in an inverse parallel configuration, and all required gating circuitry on the high voltage side of an integral, opto-coupled control voltage isolator. Rectifiers, copper leads and a ceramic substrate shall be reflow soldered to an integral heat sink for maximum heat dissipation. The SSM shall also contain a control LED, a thermistor for temperature sensing, and silver-plated control and load contacts. The entire SSM shall be sealed in a plastic housing requiring only a screwdriver to replace. Dimmers employing triac power devices, pulse transformers, or other isolating devices not providing at least 2,500V RMS isolation, shall not be acceptable. Dimmer modules requiring disassembly, heat sink grease or additional tools for repair shall not be acceptable.
2. All electronic components (current/voltage sensors and indicators) shall be contained in a single, field-replaceable housing. Modules requiring discrete wiring of electronic components shall not be acceptable.
3. SCR power switching devices shall have the following minimum ratings:

    a. Module Size
        1) 15A
        2) 20A

    b. Single Cycle Peak Surge Surrent
        1) 625A

    c. Half Cycle 12T
        1) 1,20

d. Transient Over Voltage
   1) 600V

e. Die Size
   1) .257”

D. Filtering

1. Dimmer modules shall include toroidal filters to reduce the rate of current rise time resulting from switching the SCRs. The filter shall limit objectionable harmonics, reduce lamp filament sing and limit radio frequency interference on line and load conductors. Modules shall offer 350 or 500 uS. filter rise times. Rise time shall be measured at the worst case slew rate (about 50 per-cent) from 10 to 90 percent of the output wave form with the dimmer operating at full load.
2. All dimmers shall maintain their published rise time and/or fall time regardless of duty cycle or rack temperatures. Dimmers that derate due to increased dimmer temperature caused by full load operation or high phase angles shall not be acceptable.

E. Performance

1. Power efficiency for standard dimmers shall be at least 97 percent at full load with a no-load loss of 3V RMS. The dimmer shall accept hot patching of a cold incandescent load up to the full rated capacity of the dimmer.

F. Physical

1. Dimmer modules shall be fully plug-in and factory wired. Dimmer modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Dimmer modules shall be UL Recognized.

G. Equipment

1. (X) ETC D20 Dimmer Modules

2.4 RELAY MODULES

A. General

1. The relay modules shall be the ETC Relay modules as manufactured by Electronic Theatre Controls, Inc. or equal. The relay modules shall be designed for use with Unison dimming racks.
2. Relay Modules shall consist of a heavy-duty, die-cast aluminum chassis with an integral faceplate. All parts shall be properly treated, primed and finished in fine-texture, scratch-resistant gray epoxy powder coat.
3. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable.
4. With the exception of the circuit breaker, the module shall contain no moving parts.
5. Each module shall be labeled with the manufacturer's name, catalog number and rating.
6. All electronic components (current/voltage sensors and indicators) shall be contained in a single field-replaceable housing.

B. Electrical
1. Relay module configuration shall be dual channel, 120V, 20A, as noted on the Electrical Drawings.
2. Relay modules shall be fully plug-in and factory wired.
3. Relay modules shall be UL and cUL listed power control devices with a minumum AIC rating of 10,000A.
4. Modules shall be a fully magnetic circuit breaker for each channel. Relay modules shall be rated for a minimum of 100,000 full load activations.
5. Modules shall have Signal and Load LED indicators for each channel.
6. Relay modules shall be available with advanced features providing load and status information.

C. Equipment

1. (X) ETC R20 Relay Modules

2.5 GENERAL NETWORK

A. General

1. The network shall provide data distribution over a TCP/IP network. Data shall be layer 3 routable over the Ethernet network. Systems using proprietary formats or formats other than TCP/IP or non-layer 3 routable networks shall not be accepted.
2. Connections shall be made between consoles, facepanels, architectural processors, computers and nodes over standard Ethernet distribution systems using 10/100BaseT wiring and/or 10/100BaseFL. All installations shall conform to established Ethernet wiring practice and installation shall be performed by contractors qualified to do this type of work. All wiring shall be tested at Category 5 for full bandwidth operation to the appropriate IEEE standard.
3. The Lighting Control system must be supplied by a single manufacturer and must have seamless integration over Ethernet between the Entertainment and Architectural lighting control.

B. Capacities

1. The network shall provide DMX routing and patching and prioritization for up to 32,767 DMX addresses and DMX data may be input or output from any port on any DMX node in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of nodes supported by the Ethernet topology.
2. The network shall support multiple consoles, computers, file servers, printers, and architectural processors with discrete command lines and control. The network shall support multiple venues/systems on the same network.
3. Network configuration shall be via Network Configuration Editor (NCE) software. The software shall permit complete user flexibility allowing the system operator to patch DMX data over Ethernet DMX (EDMX), assign node labels for easy identification, assign RFUs to specific systems in multi-system networks, assign DMX offsets and provide DMX port prioritization. Each node shall have a specific IP address provided automatically by the software. The user may edit this IP address. Systems that do not support simple Windows configuration or systems that do not allow complete reconfiguration of the above mentioned features over Ethernet shall not be acceptable.
4. All configuration data for each network device shall be held at the device and system operation shall not require continuous on line operation of the network configuration software.
5. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over EDMX data. The system shall be capable of alternating control of individual dimmer data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control and the

network shall allow user override of the user selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be allowed.

6. The network shall allow multiple DMX inputs assigned to the same EDMX range to be set at different priorities. This shall allow the user to assign high or low priority to each DMX input port in the network on a port by port basis. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritization shall not be allowed.

C. Operational Features

1. The video monitor outputs at any video node shall be able to monitor the video output of any compatible console connected to the network.
2. Each DMX Node shall control up to 2048 DMX addresses, within the confines of up to 64 DMX (32,767 EDMX address) “universes”. The specific DMX data input or output by the Node shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
3. Any number of DMX universes may be configured with any length up to 512 addresses as long as the total does not exceed 32,767. Any range of DMX addresses may be selected for each. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use.
4. DMX ports shall be configurable for either input or output. Multiple DMX signal routing patches and multiple facilities shall be specifically supported and limited only by the file storage capacity of the computer with Network Configuration Editor software installed.
5. File transmission, synchronization and access to File Servers using Microsoft NT server software shall be supported.
6. All Network configuration information shall be available as a system printout.

2.6 WALL MOUNTED RELAY PANEL

A. General

1. The wall mounted relay panel shall be the SmartSwitch Unit as manufactured by Electronic Theatre Controls, Inc., or equal. SmartSwitch panels shall be UL Listed and CSA Approved, and shall be so labeled when delivered.
2. The SmartSwitch-48 relay panel shall consist of up to (48) 20A relays, single pole as required, a single control electronics, sub-paneled and enclosure.

B. Mechanical

1. The panel shall be 47.27" high by 17" wide and 6.3" deep and weigh no more than 81 pounds.
2. It shall be constructed of 16-gauge steel. All panel components shall be properly treated, primed and finished in fine-textured, scratch resistant paint. The entire unit shall surface mount.
3. Equally sized top, bottom, and side removable knockout panels shall facilitate conduit entry, with an internal pass-through plenum for side-by-side or top-to-bottom mounting. The front panel shall be easily removable as well for full front access to input, output and data connections.
4. The unit shall ship with a cover complete with a locking door, allowing controlled access to the Class 2 wiring only.
5. The panel enclosure shall be available separately from the sub-panel containing the control electronics to allow for pre-installation. The panel shall be UL Listed to be available in this configuration.

C. Thermal

1. The panel shall be convection cooled.
2. The panel shall operate safely in an environment having an ambient temperature between 32° and 104°F, and humidity between 10-90% (non-condensing).

D. Electrical

1. The panel control electronics shall operate on single phase, two wire + ground, 120/277V AC 60Hz, at an amperage sufficient to power the panel (8 amps max). Standard fault current protection shall be 5,000 AIC.
2. The individual relays shall be mechanically latching and capable of switching 20A at up to 300V circuits with no derating required for inductive lighting loads.
3. Each relay shall have an integral manual override switch with on/off status indication.
4. The relay shall have the following minimum ratings:

    a. 2000A inrush current
    b. 1500A short circuit current
    c. 5000V RMS isolation
    d. 60,000 mechanical operations

5. The panel shall be capable of switching all relays on or off at once, or in a user-selectable delay period of 0.1 to 60 seconds, in 0.1 second increments, per relay.
6. All line and neutral terminals shall accept up to 12 AWG wire. The control wiring shall lang on a removable header for easy contractor installation (on-board DMX, SmartLink and Emergency Input terminations).
7. Voltage barrier(s) shall be provided to separate relays carrying normal and emergency power in the same panel. The barrier shall be capable of installation, without tools, between any two relays, and shall allow up to eight barriers per panel (4 per side).

E. Electronics

1. The control panel on the pack shall have a power status LED indicator (Blue) and a DMX status LED indicator (Green). A 6-button menu navigation keypad and a two-line-by-20-charactor backlit LCD shall be provided for system control, configuration, and control status.
2. The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the 6-button keypad. Any switch may be patched to any DMX channel.
3. The panel shall send and receive SmartLink (Echelon LonWorks with LinkPower) control protocol. Any preset and/or sequence shall be available on the SmartLink network.
4. The relays shall respond to control changes (DMX or SmartLink) in less than 25 milliseconds. DMX512 update speed shall be 40Hz.
5. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
6. The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall be respond to the contact input by switching select relays to "on", while switching other relays "off". Each relay can be selected for activation upon contact input.
7. From the control panel or optional button stations, it shall be possible to record up to 32 presets. Presets shall be programmable by recording current levels (as set by DMX), by entering levels on the facepanel directly, manually selecting relay state on each relay, or a combination of both methods. Indication of an active preset shall be visible on the LCD display.
8. The presets may be recorded sequentially as a Sequence with programmable fade and hold times, which shall allow for stand-alone operation. Indication of an active sequence shall be visible on the LCD display and on optional button stations.
9. The unit shall always power-up in the last used mode and settings and shall be ready for use without user intervention. The Power Up Behavior setting shall ensure the unit restores to its previous state (preset, sequence) when power is cycled.

10. Pack setup shall be user programmable. The control panel shall provide the following setup features:
    a. Set Menu Mode – Normal or Advanced
    b. Set language – English, French, German and Spanish
    c. Adjust LCD Contrast
    d. DMX Start Address (Normal Mode) or DMX Patching (Advanced Mode)
    e. DMX Loss Behavior – Hold Last Look, Wait and Fade, Fade to Preset
    f. Individual settings for DMX “on” and DMX “off” threshold level, per relay
    g. Allow Manual – allows the manual override switch to remain in the manual position, or reset immediately to the controlled position.
    h. Station Record – allow Presets to be recorded from Station Buttons
    i. Station Master – designates which panel shall provide synchronization timing
    j. Power Up Behavior
    k. Restore Defaults

2.7 ENTRY STATIONS

A. Button Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
    a. Unison Heritage Button stations shall operate using up to ten programmable buttons.
    b. All button stations shall be available with white, cream, ivory, gray or black faceplates, and buttons.
        1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
    c. Stations shall have indicators lights at each button or fader.
        1) Indicators shall be comprised of red, green and blue LED's
        2) Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button or fader it is associated with.
    d. All faceplates shall be designed for flush or surface mounting.
    e. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
    f. Station faceplates shall be indelibly marked for each button or fader function.
    g. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
    h. All Button and Button/Fader stations shall be shall be designed to accept the infrared signal from a remote hand held IR transmitter.
        1) The stations shall have a 60° reception angle and shall operate reliably within a 45' distance.
    i. IR Transmitters shall be available in seven or twelve button configurations. Custom transmitters may have up to 10 programmable buttons.
        1) IR transmitters shall be mounted in a hand-held black plastic controller. Transmitter dimensions shall be 1.875” wide, 6.625” long and 0.60” deep.
3. Electrical
    a. Unison control station wiring shall be an Echelon® Link power network.
        1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
        2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
        3) Network wiring may be bus, loop, home run, star or any combination of these.

4) Network insulation displacement connectors shall be provided with all stations.

4. Functional
   a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
      1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
         a) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
         b) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
      2) System macros and sequences shall be programmable via LightDesigner system software.
         a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
         b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.
      3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
         a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
         b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
   b. Station Button, Button/Fader, and Interface) control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.
      1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.
      2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.
   c. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.

B. Button/Fader Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
   a. Unison Heritage Button/Fader Stations shall operate using up to sixteen programmable faders and twelve programmable buttons.
   b. All button/fader stations shall be available with white, cream, ivory, gray or black faceplates, fader knobs, and buttons.
      1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
   c. Fader stations shall utilize standard 45-millimeter slide potentiometers.
   d. Stations shall have indicators lights at each button or fader.
      1) Indicators shall be comprised of red, green and blue LED's

2) Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button or fader it is associated with.

e. All faceplates shall be designed for flush or surface mounting.

f. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.

g. Station faceplates shall be indelibly marked for each button or fader function.

h. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.

i. All Button and Button/Fader stations shall be shall be designed to accept the infrared signal from a remote hand held IR transmitter.

1) The stations shall have a 60° reception angle and shall operate reliably within a 45' distance.

j. IR Transmitters shall be available in seven or twelve button configurations. Custom transmitters may have up to 10 programmable buttons.

1) IR transmitters shall be mounted in a hand-held black plastic controller. Transmitter dimensions shall be 1.875” wide, 6.625” long and 0.60” deep.

3. Electrical

a. Unison control station wiring shall be an Echelon® Link power network.

1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.

3) Network wiring may be bus, loop, home run, star or any combination of these.

4) Network insulation displacement connectors shall be provided with all stations.

4. Functional

a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface, or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.

1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.

a) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.

b) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.

2) System macros and sequences shall be programmable via LightDesigner system software.

a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.

b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.

3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.

a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.

b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

b. Station Button, Button/Fader, and Interface) control components shall be designed to operate standard default or custom system functions. Components shall operate default

functions unless re-assigned via LightDesigner, the Windows-based configuration program.

1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.
2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

c. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.

C. Connector Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
2. Mechanical
   a. Unison connector stations shall provide an interface to portable Unison stations.
   b. All connector stations shall be available with white, cream, ivory, gray or black faceplates, fader knobs, and buttons.
      1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
   c. All faceplates shall be designed for flush or surface mounting.
   d. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
   e. Station faceplates shall be indelibly marked for each function.
   f. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
3. Electrical
   a. Unison control station wiring shall be an Echelon® Link power network.
      1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
      2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
      3) Network wiring may be bus, loop, home run, star or any combination of these.
      4) Network insulation displacement connectors shall be provided with all stations.
4. Functional
   a. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
      1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
         a) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
         b) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
      2) System macros and sequences shall be programmable via LightDesigner system software.
         a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
         b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.
      3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.

a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

b. Station Button, Button/Fader, and Interface) control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.
1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.
2) Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.

c. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.

D. Contact Interface Station

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
2. General
a. Unison Contact Interface shall provide direct interface (in and out) to external devices via contact closure. Interface enclosure shall consist of 16 input connections and 16 output connections.
3. Mechanical
a. The surface mount enclosure and cover shall be constructed of 16- gauge (.08) steel and are finished in black smooth matte powder coat paint. The enclosure shall be 14” W x 10.5” H x 3” D.
b. Conduit access points shall be provided on the top and bottom of the unit.
c. The assembly shall consist of up to 16 connections; 8 inputs functionally coupled with 8 normally open relay contact outputs. Inputs and outputs may be configured as either maintained or momentary.
4. Electrical
a. Unison control station wiring shall be an Echelon® Link power network.
1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
3) Network wiring may be bus, loop, home run, star or any combination of these.
4) Network insulation displacement connectors shall be provided with all stations.
b. Ratings:
1) The Input Rating shall be 5V@10mA (unit requires dry contact closure)
2) Dry contact outputs shall consist of:
a) Normally-Open 2-pole contact closure outputs;
i) 1A@30Vdc.
ii) .5A@120V

2.8 ARCHITECUTRAL DIMMING RACK PROCESSOR MODULES

A. The Architectural Control Processor shall be the Unison Paradigm P-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.

B. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures and ERn Series Control Enclosures.

C. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.

1. ACP shall support functions such as station programming, macro sequencing, electronic lockout, room combine and astronomical time clock events. ACP station processor shall allow configuration of the control system via the menus. See software section for additional system details.
2. When used in a dimming enclosure, the ACP shall allow access to dimming control menus including the status screen, dimming configuration screen, backup menu, test menu and configuration menu.

D. One ACP shall be rated to drive 1024 channels of control, 1024 zones, 64 rooms, 512 presets, 62 button or button/fader stations and 6 Touchscreen Stations

E. ACP module electronics shall be convection cooled.

F. The ACP shall provide front-panel RJ45 jack, Secure Digital (SD) card slot, and Universal Serial Bus (USB) Port for configuration and data exchange.

G. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.

H. The ACP shall be contained in a plug-in assembly and require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.

1. The ACP shall support the following communications:
   a. Echelon LinkPower
   b. 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking with TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols
   c. EIA-232 serial protocol
   d. ESTA DMX512A, configurable as input or output ports
   e. Dry contact closure inputs
   f. Dry contact closure outputs, rated at 1A@30VDC

I. Equipment

1. (1) ETC Paradigm Processor
2. (1) ETC Paradigm station power module
3. (3) ETC UH10002 2 Button Entry Station with Custom Labels
4. (0) ETC UH30407 7 Button, 4 Fader Entry Station with Custom Labels
5. (2) ETC UH10005 5 Button Entry Station with Custom Labels
6. (3) ETC UPLCD Flush mount LCD with back box

2.9 EMERGENCY BYPASS DETECTION KIT

A. Where required to detect the loss of normal power and trigger special-purpose lighting presets, the detection means shall be the Emergency Bypass Detection Kit as manufactured by Electronic Theatre Controls, Inc. or equal.

B. Mechanical

1. The Kit Enclosure shall be surface mounted, constructed of 16-gauge, formed steel panels with a removable front cover.
2. The Emergency Bypass Detection Kit shall include a 3-pole, 10 amp breaker for local over-current protection and simulation of normal power loss.

    a. The enclosure shall have a lockable door to allow limited access to the over-current protection breaker.

3. All components shall be properly treated and finished.

    a. Exterior surfaces shall be finished in fine textured, scratch-resistant, powder coat paint.

4. The Emergency Bypass Detection Kit enclosure shall provide discrete high and low voltage wiring compartments with voltage barrier.
5. Emergency Bypass Detection Kit dimensions and weights shall not exceed:

    a. Dimensions: 10.5" H x 14" W x 4.2" D
    b. Weight: 11 lbs.

6. Accessories:
    a. Emergency Bypass Detection Tap Kit

        1) The Emergency Bypass Detection Kit shall support an optional tap kit for normal power loss sensing within an ETC Unison DRd Enclosure.
        2) The Tap Kit shall provide fused over-current protection for sense feed wiring without the need for an external circuit breaker.
        3) The Tap Kit shall install within an ETC Unison DRd Enclosure.

    b. Weight: 11 lbs.

C. Electrical

1. Emergency Bypass Detection enclosure shall support 100 to 277 V configurations.

    a. Emergency Bypass Detection Kit shall be field configurable for single-phase, bi-phase and three-phase operation without the need for additional components.

2. Phase Loss Detection circuitry shall provide 0.5 second delay to prevent nuisance tripping.
3. The Emergency Bypass Detection Kit shall provide an integrated circuit breaker for local over-current protection and simulation of normal power loss.
4. The Emergency Bypass Detection Kit shall support isolated outputs for connection to multiple dimming products simultaneously

    a. Three isolated contacts shall be provided.
    b. Each contact shall support connection of up to four dimming products.

5. The Emergency Bypass Detection Kit shall be completely pre-wired by the manufacturer. The contractor shall provide input feed and control wiring.
6. All control wire connections shall be terminated via factory provided connectors.
   a. Factory provided connectors shall support 12 AWG to 20 AWG wiring.
   b. Emergency lighting input shall support load shedding.

7. The Emergency Bypass Detection Kit shall provide a normally-closed input for interface with fire alarm systems.
8. The Emergency Bypass Detection Kit shall be UL and cUL Section 924 Listed for interaction with similarly listed dimming and switching panels.

D. Thermal

1. Ambient room temperature: 32-104°F
2. Ambient humidity: 10-90% non-condensing

2.10 CONDUCTORS AND CABLES

A. Class 1, 2, and 3 Control Cable: Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Unshielded, Twisted-Pair Data Cable: Category 6. Comply with requirements in Section 27 15 00 "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method:

1. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
2. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 27 15 00 "Communications Horizontal Cabling."
3. Minimum conduit size shall be 1/2 inch.

C. It shall be the responsibility of the Theatrical Contractor to receive and store the necessary materials and equipment for installation of the dimmer system. It is the intent of these specifications and plans to include everything required for proper and complete installation and operation of the dimming system, even though every item may not be specifically mentioned. The contractor shall deliver on a timely basis to other trades any equipment that must be installed during construction.

D. The Theatrical Contractor shall be responsible for field measurements and coordinating physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

E. The Theatrical Contractor shall install all lighting control and dimming equipment in accordance with manufacturer's approved shop drawings.

F. All branch load circuits shall be live tested before connecting the loads to the dimmer system load terminals.

3.2 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for identifying components and power and control wiring.

B. Label each dimmer module with a unique designation.

C. Label each scene control button with approved scene description.

3.3 FIELD QUALITY CONTROL

A. Upon completion of the installation, including testing of load circuits, the contractor shall notify the dimming system manufacturer that the system is available for formal checkout.

B. Notification shall be provided in writing, two weeks prior to the time that factory-trained personnel are needed on the job site.

C. No power is to be applied to the dimming system unless specifically authorized by written instructions from the manufacturer.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

    a. Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

3. Emergency Power Transfer: Test listed functions.

E. Electrical Contractor shall be liable for any return visits required by the factory-authorized service representation as a result of incomplete or incorrect wiring.

F. Remove and replace malfunctioning dimming control components and retest as specified above.

G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central dimming controls.

END OF SECTION 260933

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

A. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

2.2 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Taps for Transformers 15 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

F. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

G. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

H. Wall Brackets: Manufacturer's standard brackets.

2.3 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Electronic-grade panelboards.

1.3 DEFINITIONS

A. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is

operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.

5. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D; I-Line Series or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D, NF or NQ Series or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
h. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 72 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Isolated-ground receptacles.
3. Weather-resistant receptacles.
4. Snap switches.
5. Wall-switch occupancy sensors.
6. Cord and plug sets.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.3 GFCI RECEPTACLES

A. General Description:

1. Duplex GFCI Convenience Receptacles, 125 V, 20 A.
2. Straight blade, feed-through type.
3. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
4. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

2.4 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.05-inch- thick, anodized aluminum.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.
2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Current-limitation curves for fuses with current-limiting characteristics.

1.5 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.2 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Feeders: Class J, fast acting.

2. Motor Branch Circuits: Class RK5, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Molded-case circuit breakers (MCCBs).
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

C. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

D. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Electrical Operator: Provide remote control for on, off, and reset operations.
8. Accessory Control Power Voltage: Integrally mounted, self-powered;.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Commissary and Concessions Areas: NEMA 250, Type 4X, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.

1.3 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. MCP: Motor circuit protector.

C. N.C.: Normally closed.

D. N.O.: Normally open.

E. OCPD: Overcurrent protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.

2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.

1.7 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Indicating Lights: Two of each type and color installed.
3. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
4. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Configuration: Nonreversing.
2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.

3. Surface mounting.
4. Red or green pilot light.

C. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, type.

a. Push Buttons: Shrouded types; momentary as indicated.
b. Pilot Lights: LED types; colors as indicated; push to test.
c. Selector Switches: Rotary type.

B. Reversible N.C./N.O. auxiliary contact(s).

C. Spare control wiring terminal blocks, quantity as indicated; unwired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

F. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect and Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.

6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect before increasing settings.

C. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

3.6 PROTECTION

A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Exit signs.
3. Retrofit kits for fluorescent lighting fixtures.

B. Related Sections:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, inclucding occupancy and vacancy sensors.
2. Section 260933 "Architectural Dimming Controls" for architectural dimming systems.
3. Section 262726 "Wiring Devices" for toggle switches.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Ballast, including BF.
3. Energy-efficiency data.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

1. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Certified Data: Photometric data shall be certified by either a qualified independent testing agency or a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, must be available for each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. Testing Agency Certified Data: Photometric data shall either be certified by a qualified independent testing agency or by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, basis-of-design products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings, unless specifically noted otherwise.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Lamps, ballasts, and designated lighting fixtures shall be eligible for incentives under the Efficiency Maine Business Program, Prescriptive Incentives. In general, all lamps and ballasts should comply with the CEE High-Performance Commercial Lighting Systems Initiative criteria. (http://www.cee1.org/com/com-lt/lamps-ballasts.xls) Fixture efficiencies must meet Efficiency Maine minimum standards as noted in the Light Fixture Schedule.

B. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.

b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
d. ANSI ballast type (M98, M57, etc.) for HID luminaires.
e. CCT and CRI for all luminaires.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF (nominal): 0.88 for T8 lamps. 1.0 for T5 or T5HO lamps.
10. Power Factor: 0.95 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8, T5, and T5HO Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.

a. High-Level Operation: 100 percent of rated lamp lumens.
b. Low-Level Operation: 30 or 50 percent of rated lamp lumens, depending on the fixture designation.

2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
9. Power Factor: 0.95 or higher.

2.5 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.6 FLUORESCENT LAMPS

A. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 3100 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life 24,000 hours, unless otherwise indicated.

B. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches, 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

C. T5HO rapid-start, high-output lamps, rated 24 W maximum, nominal length of 21.6 inches, 2000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

D. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.

1. 18 W: T5, twin tube, rated 1200 initial lumens (minimum).

2. 26 W: T4, double or triple tube, rated 1710 initial lumens (minimum).
3. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).

2.7 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

A. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

D. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Grounding.

B. Related Requirements:

1. Section 270536 "Cable Trays for Communications Systems" for cable trays and accessories.
2. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
3. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.
4. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. LAN: Local area network.

C. RCDD: Registered Communications Distribution Designer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, or field inspector.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.2 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belden Inc.
2. Cooper B-Line.
3. Hubbell Premise Wiring.
4. Middle Atlantic Products, Inc.

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310-D standard, 19-inch panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Power strip.
9. All cabinets keyed alike.

E. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.3 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Rack mounting.
3. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
4. LED indicator lights for power and protection status.
5. LED indicator lights for reverse polarity and open outlet ground.
6. Cord connected with 15-foot line cord.
7. Rocker-type on-off switch, illuminated when in on position.

2.4 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with J-STD-607-A.

2.5 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

END OF SECTION 271100

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Coaxial cable.
3. Cable connecting hardware, patch panels, and cross-connects.
4. Cabling system identification products.
5. Cable management system.

B. Related Requirements:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. IDC: Insulation displacement connector.

F. LAN: Local area network.

G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

H. RCDD: Registered Communications Distribution Designer.

I. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: Forqualified layout technician, installation supervisor, and field inspector.

B. Field quality-control reports.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Device Plates: One of each type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. CommScope, Inc.
3. Genesis Cable Products; Honeywell International, Inc.
4. Superior Essex Inc.
5. SYSTIMAX Solutions; a CommScope, Inc. brand.

B. Description: 100-ohm, four-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

    a. Communications, General Purpose: Type CM or CMG; or MPP, CMP, MPR, CMR, MP, or MPG.
    b. Communications, Plenum Rated: Type CMP or MPP, complying with NFPA 262.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden Inc.
2. Hubbell Premise Wiring.
3. Leviton Commercial Networks Division.
4. Panduit Corp.
5. Siemon Co. (The).

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

F. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

2.5 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathways and cables except in unfinished spaces, unless noted otherwise.

1. Install plenum cable above all accessible ceilings and where exposed.
2. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."
3. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible. Cables may be installed exposed within cable trays in unfinished spaces.

C. Wiring within Enclosures:

1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.

D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

4. UTP Performance Tests:

    a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

        1) Wire map.
        2) Length (physical vs. electrical, and length requirements).
        3) Insertion loss.
        4) Near-end crosstalk (NEXT) loss.
        5) Power sum near-end crosstalk (PSNEXT) loss.
        6) Equal-level far-end crosstalk (ELFEXT).
        7) Power sum equal-level far-end crosstalk (PSELFEXT).
        8) Return loss.
        9) Propagation delay.
        10) Delay skew.

5. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

    a. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 271500

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Firefighters' two-way telephone communication service.
7. Firefighters' smoke-control station.
8. Magnetic door holders.
9. Remote annunciator.
10. Graphic annunciator.
11. Addressable interface device.
12. Digital alarm communicator transmitter.
13. Radio alarm transmitter.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Record copy of site-specific software.
g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.

3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

h. Manufacturer's required maintenance related to system warranty requirements.
i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
3. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
4. Keys and Tools: One extra set for access to locked or tamperproofed components.
5. Audible and Visual Notification Appliances: One of each type installed.
6. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.9 PROJECT CONDITIONS

A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and voice/strobe evacuation.

B. Automatic sensitivity control of certain smoke detectors.

C. All components provided shall be listed for use with the selected system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Automatic sprinkler system water flow.
6. Commissary/concessions fire-extinguishing system operation.
7. Fire pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Recall elevators to primary or alternate recall floors.
9. Activate emergency lighting control.
10. Activate emergency shutoffs for gas and fuel supplies.
11. Record events in the system memory.
12. Record events by the system printer.
13. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Elevator shunt-trip supervision.
3. Fire-pump loss of power.
4. Fire-pump power phase reversal.
5. User disabling of zones or individual devices.
6. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.

2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

E. System Supervisory Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
2. Record the event on system printer.
3. After a time delay of 180 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
4. Display system status on graphic annunciator.

2.3 FIRE-ALARM CONTROL UNIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Faraday
2. GAMEWELL.
3. Notifier.
4. Siemens Industry, Inc.; Fire Safety Division.
5. Silent Knight.
6. SimplexGrinnell LP.

B. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
b. Include a real-time clock for time annotation of events on the event recorder and printer.
c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
d. The FACP shall be listed for connection to a central-station signaling system service.
e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B.
2. Pathway Survivability: Level 1.
3. Install no more than 256 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

    a. One dedicated RS 485 port for remote station operation using point ID DACT.
    b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    c. One USB port for PC configuration.
    d. One RS 232 port for voice evacuation interface.

E. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

F. Elevator Recall:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.

H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided in a separate cabinet located in the fire command center.

1. Status Annunciator: Indicate the status of firefighters' two-way telephone communication zones.
2. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, supervisory and digital alarm communicator transmitters, and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
c. Multiple levels of detection sensitivity for each sensor.
d. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.
e. Sensor range (normal, dirty, etc.).

3. Each sensor shall have multiple levels of detection sensitivity.
4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
5. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.6 PROJECTED BEAM SMOKE DETECTORS

A. Projected Beam Light Source and Receiver: Designed to accommodate small angular movements and continue to operate and not cause nuisance alarms.

B. Detector Address: Accessible from fire-alarm control unit and able to identify the detector's location within the system and its sensitivity setting.

C. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

1. Primary status.
2. Device type.

3. Present average value.
4. Present sensitivity selected.
5. Sensor range (normal, dirty, etc.).

2.7 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field.
b. 177 cd.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

C. Voice/Tone Notification Appliances:

1. Comply with UL 1480.

2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: Semirecessed or surface mounted and bidirectional.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.9 FIREFIGHTERS' TWO-WAY TELEPHONE COMMUNICATION SERVICE

A. Dedicated, two-way, supervised, telephone voice communication links between fire command center and remote firefighters' telephone stations. Supervised telephone lines shall be connected to talk circuits by controls in a control module. Provide the following:

1. Common-talk type for firefighter use only.
2. Selective-talk type for use by firefighters and fire wardens.
3. Controls to disconnect phones from talk circuits if too many phones are in use simultaneously. An indicator lamp shall flash if a phone is disconnected from the talk circuits.
4. Addressable firefighters' phone modules to monitor and control a loop of firefighter phones. Module shall be capable of differentiating between normal, off-hook, and trouble conditions.
5. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote telephone is taken off the hook, it causes an audible signal to sound and a high-intensity lamp to flash at the fire command center.
6. Selector panel controls to provide for simultaneous operation of up to six telephones in selected zones. Indicate ground faults and open or shorted telephone lines on the panel front by individual LEDs.
7. Display: Graphic to indicate location of caller.
8. Remote Telephone Cabinet: Flush- or surface-mounted cabinet as indicated, factory-standard red finish, with handset.

    a. Install one-piece handset to cabinet with vandal-resistant armored cord. Silk-screened or engraved label on cabinet door, designating "Fire Emergency Phone."
    b. With "break-glass" type door access lock.

9. Remote Telephone Jack Stations: Single-gang, stainless-steel-plate mounted plug, engraved "Fire Emergency Phone."
10. Handsets: Six sets with noise-canceling microphone stored in a cabinet in the fire command center.

2.10 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Initiate Smoke-Management Sequence of Operation:

1. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
2. Subsequent devices going into alarm condition automatically activate the smoke-control functions.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.11 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

B. Provided by Div. 8 Door Hardware. Controlled by fire alarm system.

2.12 GRAPHIC ANNUNCIATOR

A. Graphic Annunciator Workstation: PC-based, with fire-alarm annunciator software with historical logging, report generation, and a graphic interface showing all alarm points in the system. PC with operating system software, minimum 750 GB hard drive, 27-inch digital display monitor, with wireless keyboard and mouse.

2.13 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

2.14 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall, and to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.15 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.16 RADIO ALARM TRANSMITTER

A. Transmitter shall comply with NFPA 1221 and 47 CFR 90.

B. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.

1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
3. Normal Power Input: 120-V ac.

4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
7. Antenna-Cable Connectors: Weatherproof.
8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

C. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:

1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
6. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
3. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install wall-mounted devices not less than 6 inches below the ceiling, but not more than 96 inches above the floor. Install all devices at the same height unless otherwise indicated.

1. Ceiling mounted devices shall be surface mounted to the ceiling.

J. Visible Alarm-Indicating Devices: Install adjacent to each audible alarm devices and at least 6 inches below the ceiling, but not more than 96 inches above the floor. Install all devices at the same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

L. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists 100-mph wind load with a gust factor of 1.3 without damage.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.

B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
2. Magnetically held-open doors.
3. Electronically locked doors and access gates.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at elevator shunt-trip breaker.
9. Data communication circuits for connection to building management system.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction and Owner.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.

    a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication,

cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Removing existing trees, shrubs, groundcovers, plants, and grass.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.

B. Related Sections include the following:

1. ~~Division 01 Section "Sustainable Design Requirements" for additional LEED requirements.~~
2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities procedures.
3. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
4. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings or structures undergoing alterations.
5. Division 32 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.
6. Division 31 Section "Earth Moving for Structures and Pavement" for soil materials, excavating, backfilling, and site grading.
7. Division 31 Section "Earth Moving for Utilities" for soil materials, excavating and backfilling.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

C. Selective Clearing: Within the limits designated on the contract drawings (selective clearing should never take place within wetland areas), remove all, dead, dying, or diseased trees. Also trim as needed or remove trees that pose a hazard such as hanging over power lines or are leaning more than 30 degrees from vertical. Avoid/consult with the owner and/or engineer/architect on trees that fit this criteria but are considered specimen trees. (18” or larger caliper)

1.4 MATERIAL OWNERSHIP

A. Except other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Performing site clearing on property adjoining Owner's property is prohibited.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises or adjoining property where indicated.

D. Utility Locator Service (Dig Safe): Notify Dig Safe (1-888-344-7233) for area where Project is located before site clearing operations has begun. Follow appropriate procedure and regulations as required.

E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner and Architect

3.2 TREE PROTECTION

A. Refer to section 015639 Temporary Tree and Plant Protection.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
4. Use only hand methods for grubbing within tree protection zone.
5. Chip removed tree branches and utilize for temporary erosion control measures. If can not be used, remove

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

3.6 DISPOSAL

A. Disposal: Remove surplus soil material, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.
2. Excess topsoil remains the property of the Owner.

END OF SECTION 311000

SECTION 312000 – EARTH MOVING FOR STRUCTURES AND PAVEMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes performing site preparation, excavation, borrow, filling, backfilling, compaction, compaction testing, and finish grading necessary to construct the finished grades indicated for structures, pavements, and other on-grade slabs or site work. Requirements for excavating and backfilling for utility lines and storm drains are contained in Section 312100, "Earth Moving for Utilities".

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities procedures.
2. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
3. Division 32 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.
4. Division 31 Section "Earth Moving for Utilities" for soil materials, excavating, backfilling.
5. Division 31 Section "Dewatering" for requirements and guidelines for dewatering procedures.
6. Division 31 Section “Excavation Support and Protection" for requirements and guidelines for temporary excavation support.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C136	2006 Sieve Analysis of Fine and Coarse Aggregates
ASTM D698	2007 (Rev. 1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))
ASTM D1557	2007 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
ASTM D1586	2008 (Rev. A) Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

ASTM D2487	2006 (Rev. 1) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2729	2003 Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D2855	1996 (Rev. 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D6938	2008 (Rev. A) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D3212	2007 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F402	2005 Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F758	1995 (Rev 2007, E1) Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

ARMY CORPS OF ENGINEERS (COE)

COE EM-385-1-1	2008 Safety and Health Requirements Manual

State of Maine, Department of Transportation MDOT Standard Specifications, 12/2002 and amendments

B. Reference Standard Specifications: Materials and workmanship specified herein with reference to MDOT Maine State Standard shall be in accordance with the referenced articles, sections and paragraphs of the standard except that contractual and payment provisions do not apply.

1.4 DEFINITIONS

A. Coarse Aggregate: A layer of clean, poorly graded crushed rock, stone, or gravel having a high porosity which is placed beneath or adjacent to a building slab or structure with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below or adjacent a slab or structure.

B. Compaction: The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D698 or ASTM D1557 for general soil types abbreviated in this specification as " _____ percent ASTM D1557 maximum density".

C. Structural Fill: Granular fill material constructed to attain maximum bearing strength and minimize consolidation or differential settlement under a load.

D. Excavation: The removal of soil, rock, or hard material to obtain a specified depth or elevation.

E. Hard Material: Weathered rock, dense consolidated deposits or conglomerate materials, (excluding manmade materials such as concrete) which are not included in the definition of "rock" but which usually require the use heavy excavation equipment with ripper teeth or the use of jack hammers for

removal. Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D1586 between 60 and 120 blows per foot is arbitrarily defined herein as "Hard Material".

F. Undisturbed Native Soil: Existing in place soil.

G. Lift: A layer (or course) of soil placed on top of a previously prepared or placed soil. Lift thickness shall be such that desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Lift thickness shall not exceed 18 inches.

H. Rock: Solid, homogeneous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement, exceeding three (3) cubic yard in volume. Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D1586 greater than 120 blows per foot is arbitrarily defined herein as "Rock." Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

I. Ledge: Where used in this section, the term "Ledge" and "Rock" shall be considered the same and may be used interchangeably. The definition of "Ledge" shall be the same as "Rock" as defined in this section.

J. Soil: The unconsolidated surface material of the earth's crust resulting from the chemical and mechanical weathering of rock and organic material.

K. Subgrade: The material in excavation (cuts) and fills (embankments) immediately below any subbase, base, pavement, or other improvement. Also, as a secondary definition, the level below which work above is referenced.

L. Granular Fill: A dense, well-graded aggregate mixture of sand-gravel or crushed stone with suitable binder soil, placed on a subgrade to provide a suitable foundation for further construction.

M. Loam: In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Loam may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all loam references in this contract. The material shall be representative of productive soils in the vicinity.

N. Unsatisfactory Material: Existing, in-place soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability. Materials classified as PT, OH, or OL by ASTM D2487 are unsatisfactory. Unsatisfactory materials also include poor manmade fills, refuse, frozen material, uncompacted backfills for previous construction, unsound rock or soil lenses, or other deleterious or objectionable material.

O. Fine Aggregate: Aggregate passing the 3/8-inch sieve and almost entirely passing the No. 4 sieve and predominantly retained on the No. 200 sieve, as determined by ASTM C125.

1.5 SUBMITTALS

A. Record of Existing Conditions

1. Preblast Survey

B. Statement

1. Blasting plan (3.3.1.C)

C. Field Test Reports (Note - Reports shall be as specified herein and as per applicable ASTM Standards).

1. All aggregate, granular fill tests/gradation report. (Produced within the past year)
2. Subsurface drains, granular fill tests
3. Structural fill material tests/compaction report.
4. Compaction tests
5. General site fill/gradation report.
6. Stone dust/gradation report
7. As specified within this section.

1.6 DELIVERY AND STORAGE

A. Deliver and store materials in a manner to prevent contamination or segregation. Store synthetic fiber filter cloth to prevent exposure to direct sunlight in accordance with the manufacturer's written recommendations.

1.7 CRITERIA FOR BIDDING

A. Base bids on the following criteria (field verify existing conditions):

1. Surface elevations as indicated. If not indicated, verify in the field.
2. Pipes or other man-made obstructions, aside from those indicated on the drawings could be encountered. Field verify existing conditions.
3. The character of the material to be excavated or used for subgrade is as indicated. If not indicated, field verify. Hard material identified as conglomerate clay, sand, silt, or gravel, volcanic tuff, or consolidated calcareous marine sediments on the borings shall not be considered as rock and removal of such material shall not give cause for a claim for additional compensation regardless of hardness or difficulty in removing.
4. Removal of rock to the lines and grades indicated and required shall be done at the unit price bid (on the bid form) for "Mass or Trench Excavation". The unit price shall include all of the site contractors' costs associated with rock removals including but not limited to: watchmen; signage and advertising, etc., video/preblast surveys and water quality samples of wells within 500-foot radius of the anticipated blasting areas.
5. Ground water elevations indicated are based on observations at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
6. Borrow material, Suitable backfill and fill material in the quantities required is not available at the project site.
7. Blasting will be permitted, obtain Architect/Owner permission. Remove material by drilling and use of expansion jacks for feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers, or as approved by the Architect/Engineer.
8. The unit price for mass or trench rock shall include the entire cost to drill, blast, remove and/or dispose of rock material as required.

1.8 SITE CONDITIONS

A. Utilities: Contact the Architect/Engineer 72 hours prior to construction for the location of all existing underground utilities. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Contact the utility companies for locations of their utilities. Perform work adjacent to privately owned utilities in accordance with procedures outlined by the utility company. Excavation made with power-driven equipment is not permitted within two feet of known utilities or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work as affected by the contract excavation until approval for backfill is granted by the Architect/Engineer. Report damage to utility lines or subsurface construction immediately to the utility Owner. Notify the Architect/Engineer immediately.

1.9 ADDITIONAL CRITERIA REGARDING ROCK REMOVAL

A. For concrete slabs and footings for the buildings, the following shall also apply:

1. When ledge is encountered, thoroughly clean off the ledge; contact the Architect for their inspection of such ledge.
2. Remove any ledge which is fractured or weathered or otherwise unsuitable (as determined by the Architect).
3. If the Architect determines that the rock is sound, then construct the footings on such sound rock.
4. Footings shall be installed at the required minimum depth of cover as determined by the Architect/Engineer.

1.10 ROCK EXCAVATION

A. Boulders three (3) cubic yard or smaller shall be considered to be unclassified material regardless of location. Concrete and cut stone encountered in excavation in excess of three (3) cubic yard will be considered as "rock" as herein defined.

B. The word "trenches" as used herein shall mean excavation for utility lines having vertical sides whose depths exceed their width. Excavations for building foundation walls, retaining walls, and other structures other than utility lines shall not be classified as trench excavation.

C. When, during the process of excavation, rock is encountered, such material shall be uncovered and exposed and the Architect and/or Engineer shall be notified by the Contractor before proceeding further. The Contractor shall not proceed with the excavation of material claimed as rock until the material has been classified by the Architect or the Engineer. Failure on the part of the Contractor to uncover such material or notify the Architect or Engineer will forfeit the Contractor's right-of-claim for any compensation.

D. The Contractor shall employ at their expense a registered land surveyor acceptable to the Architect and/or Engineer to take cross sections of rock before removal of same and provide computations of cross sections within the limit of excavation lines. The contractor shall provide this information to the Architect/Engineer for review prior to beginning any blasting.

E. Rock payment lines for building excavation will permit 6 inches of overblow in all directions from footing. Rock payment lines for trenches will permit 6 inches of overblow in all directions from bedding as shown in the Drawings (min. 36" width for payment).

F. For the purposes of computing compensation, the payment limits for excavation will be not over 18 inches beyond face of foundation wall in any horizontal direction. Excavations which are made beyond these limits shall be so executed at the Contractor's risk without compensation. Payments will not be made for excess excavations caused by methods of operations used by the Contractor. Unauthorized excess excavations shall be at the Contractor's risk and expense.

G. All rock excavated shall be removed from the site and disposed of by the Contractor.

H. All lines and grade work not presently established at the site shall be laid out by the Contractor in accordance with the Contract Documents. Establish permanent bench marks by employment of a registered land surveyor or professional Civil Engineer. Maintain all established bounds and bench marks and replace any which are destroyed or disturbed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate: Provide clean crushed stone or gravel similar to MDOT 703.02 with the following gradation (design size 3/4"):

Sieve	% by Weight Passing
1 inch	100
3/4 inch	90 – 100
1/2 inch	45 – 80
3/8 inch	20 – 55
1/4 inch	5 – 20
No. 4	0 – 10
No. 8	0 – 5
No. 200	1.5 max.

B. Gas Permeable Coarse Aggregate: Provide clean crushed stone or gravel per ASTM E1465 Type 2 Medium Aggregate with the following gradation:

Sieve	% by Weight Passing
1 inch	100
3/4 inch	90 – 100
1/2 inch	20 – 55
3/8 inch	0 – 15
No. 4	0 – 5

Note: Void space must be at least 40%

C. Granular Fill: Provide a dense, well-graded aggregate meeting gradation requirements stated in Section 703.06 Type B, MDOT State Standard and as follows:

Sieve	% by Weight Passing
4 inch	100

½ inch	35-75
¼ inch	25-60
No. 40	0-25
No. 200	0-5

D. Granular Base: Provide a well-graded aggregate of screened or crushed gravel, hard durable and uniform rock and shall consist of clean, angular fragments, free of objectionable matter including but not limited to rounded stone, silt and clay or other deleterious material. It shall be similar to MDOT section 703.06, Type A aggregate and as follows:

Sieve	% by Weight Passing
2-1/2 inch	100
1/2 inch	45-70
1/4 inch	30-55
No. 40	0-20
No. 200	0-5

E. Granular Subbase: Provide a well-graded aggregate of screened or crushed gravel, hard durable and uniform rock and shall consist of clean, angular fragments, free of objectionable matter including but not limited to rounded stone, silt and clay or other deleterious material. It shall be similar to MDOT section 703.06, Type C Aggregate and as follows:

Sieve	% by Weight Passing
6 inch	100
1/4 inch	25-70
No. 40	0-30
No. 200	0-5

F. Crushed Aggregate Subbase: Crushed Aggregate subbase to be as follows:

1. As per Maine DOT crushed aggregate subbase 703.06, Type D material and as follows:

   a. The gradation of the part that passes a 3 inch sieve shall meet the following grading requirements:

Sieve	% by Weight Passing
1/4 inch	25-70
No. 40	0-30
No. 200	0-7

   Granular subbase to be non-frost susceptible. Granular subbase shall not contain particles of rock that will not pass a 6 inch square mesh sieve.

G. Fine Aggregate: Fine Aggregate to be as follows:

1. As per MDOT 703.01, Fine Aggregate and as follows: Provide aggregate meeting requirements as described below.

Sieve	% by Weight Passing
3/8 inch	100
No. 4	90-100
No. 8	80-100
No. 16	50-85
No. 30	25-60

No. 60	10-30
No. 100	2-10
No. 200	0-5

H. Soil Materials: Provide materials free from debris, roots, wood, scrap materials, vegetable matter, refuse or frozen material. Maximum particle size permitted is 6-inches unless otherwise indicated on the drawings. Use excavated material from the site for the work indicated when material falls within the requirements specified herein.

I. Structural Fill: Provide materials classified as "Granular Fill" where indicated. Structural fill may also include non-frost susceptible "General Site Fill" located a minimum of 18" from foundation walls or adjacent to utilities, or a minimum of 12" away from building slabs, pavements or as indicated on the drawings or specified. System to be as follows:

1. Lifts to be a maximum of 9" thick.
2. Compact each lift to 95% compaction as determined by ASTM D1557.
3. Then add the next lift.

J. General Site Fill: Provide a soil material from the site or borrow that can be readily compacted to the specified densities and meeting requirements as follows:

Sieve	% by Weight Passing
6 inch	100
3 inch	90-100
1/4 inch	25-90
No. 40	0-50
No. 200	0-20

Materials shall be free of organic material, peat, clay, and other similar soft materials and may include blast ledge material up to 6" in diameter.

K. Loam: Loam shall be as covered in Section 329200 - "Turf and Grasses."

L. Stone Dust: Stone dust shall consist of clean, washed concrete sand or stone dust free from vegetable matter lumps or balls of clay and other deleterious substances conforming to the following gradation requirements:

Sieve Size	% Passing
3/8"	100
No. 4	90-96
No. 100	10-30

NOTE: Do not use mason sand or Limestone screenings.

M. French Drain Stone: Stone for French drains shall be hard durable rock or blasted ledge pieces to be as follows:

1. As per MDOT 703.24, Stone for French Drains and as follows:

a. The gradation of the entire sample shall meet the following gradation requirements:

Sieve	% by Weight Passing
6 inch	90-100

1-1/2 inch	0-40
No. 4	0-5

Gradation tests shall conform to AASHTO T27 except that the total sample shall be sieved and the minimum weight of the sample will be 120lbs.

N. Crushed Stone: Crushed Stone shall be obtained from uniform and durable rock and shall consist of clean, angular fragments of quarried rock, free of objectionable matter and to be as follows:

1. As per MDOT 703.31, Crushed Stone and as follows:

a. The stone, which is similar to railroad ballast, shall meet the following gradation requirements in the entire sample taken from the stockpile at the source:

Sieve	% by Weight Passing
2-1/2 inch	100
2 inch	90-100
1 inch	0-30
3/4	0-5

O. No. 2 Stone: No. 2 Stone shall be uniform and durable rock and shall consist of clean, angular fragments of quarried rock, free of objectionable matter including rounded stone and to be as follows:

1. As per ASTM No.2 material and as follows (Nominal size listed as 2- ½" to 1- ½"):::

a. The gradation of the entire sample shall meet the following gradation requirements:

Sieve	% by Weight Passing
3 inch	100
2-1/2 inch	90-100
2 inch	35-70
1-1/2 inch	0-15
3/4	0-5

P. No. 357 Stone: No. 357 is a class 1 aggregate fill consisting of stone that shall be uniform and durable rock and shall consist of clean, angular fragments of quarried rock, free of objectionable matter including but not limited to rounded stone, silt and clay, and to be as follows:

1. As per ASTM No.357 material and as follows (Nominal size listed as 2" to No.4):

a. The gradation of the entire sample shall meet the following gradation requirements:

Sieve	% by Weight Passing
2-1/2 inch	100
2 inch	95-100
1 inch	35-70
1/2 inch	10-30
No. 4	0-5

Q. No. 57 Stone: No. 57 is a class 1 aggregate fill consisting of stone that shall be uniform and durable rock and shall consist of clean, angular fragments of quarried rock, free of objectionable matter including but not limited to rounded stone, silt and clay, and to be as follows:

1. As per ASTM No.57 material and as follows (Nominal size listed as 1" to No.4):

   a. The gradation of the entire sample shall meet the following gradation requirements:

Sieve	% by Weight Passing
1-1/2 inch	100
1 inch	95-100
1/2 inch	25-60
No. 4	0-10
No. 8	0-5

R. No. 67 Stone: No. 67 is a class 1 aggregate fill consisting of stone that shall be uniform and durable rock and shall consist of clean, angular fragments of quarried rock, free of objectionable matter including but not limited to rounded stone, silt and clay, and to be as follows:

1. As per ASTM No.67 material and as follows (Nominal size listed as 3/4" to No.4):

   a. The gradation of the entire sample shall meet the following gradation requirements:

Sieve	% by Weight Passing
1 inch	100
3/4 inch	90-100
3/8 inch	20-55
No. 4	0-10
No. 8	0-5

S. No. 7 Stone: No. 7 is a class 3 aggregate fill consisting of stone that shall be uniform and durable rock and shall consist of clean, angular fragments of quarried rock, free of objectionable matter including but not limited to silt and clay, and to be as follows:

1. As per ASTM No.7 material and as follows (Nominal size listed as 1/2" to No.4):

   a. The gradation of the entire sample shall meet the following gradation requirements:

Sieve	% by Weight Passing
3/4 inch	100
1/2 inch	90-100
3/8 inch	40-70
No. 4	0-15
No. 8	0-5

(Note: When specified as No.7 pea gravel; the material may be of rounded stone where specified and is intended to be washed material of an open graded design size consisting of mainly 3/8"-1/4" stone particles)

T. River Rock: River rock shall be durable rounded rock and shall be clean and free of objectionable matter and debris and shall be as follows:

1. River Rock shall be a rounded "rip-rap like" material and as follows:

   a. Rock: fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. The size of the fragments shall be such that no individual fragment exceeds a weight of 150

pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Specific gravity of the rock shall be a minimum of 2.50. The inclusion of more than trace 1% quantities of dirt, sand, clay, and rock fines will not be permitted.

b. Filter fabric and bedding shall conform as indicated or as described for regular angular rip rap included specification section 312100 “Earth Moving for Utilities”.

2.2 GEOTEXTILE FABRICS

A. As specified on drawings or in Section 313000, "Sedimentation and Erosion Control Measures”

1. Fabric: woven polypropylene separation geotextile, possessing the following characteristics:

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D 4632	N (lbs)	1402 (315)	1402 (315)
Grab Tensile Elongation	ASTM D 4632	%	12	
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	503 (113)	503 (113)
CBR Puncture Strength	ASTM D 6241	N (lbs)	4005 (900)	
Apparent Opening Size (AOS) *	ASTM D 4751	mm (U.S. Sieve)	0.43 (40)	
Permittivity	ASTM D 4491	sec^{-1}	0.05	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	163 (4.0)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70	

* ASTM D 4751, AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D 5261	g/m^2 (oz/yd^2)	203 (6.0)	
Thickness	ASTM D 5199	mm (mils)	0.6 (25)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	5.3 x 78.7 (17.5 x 258)
Roll Area	--	m^2 (yd^2)	418 (500)	418 (500)
Estimated Roll Weight	--	kg (lb)	109 (240)	109 (240)

2. Acceptable products: Mirafi 600X or approved equal.

PART 3 - EXECUTION

3.1 PROTECTION

A. Shoring and Sheeting: Provide shoring bracing, underpinning and sheeting where required. In addition to Section XXIII A and B of COE EM-385-1-1, and other requirements of this contract meet the following:

1. Prevent undermining of pavements, foundations and slabs.
2. Slope banks where space permits.

3. Where shoring and sheeting materials remain in place in completed work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 3-feet below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.

B. Dewatering: Dispose of surface water, which may accumulate in open excavations, unfinished fills, or other low areas. Remove water by trenching where approved, pumping, or other methods to prevent softening of exposed surfaces. Surface dewatering plan shall include rerouting of any storm water runoff or natural drainage if necessary and shall comply with environmental requirements. Collect and dispose of surface and subsurface water encountered in the course of construction.

C. Water Removal: Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation. Before excavating below ground water level, place the dewatering system into operation. Lower the water levels at least one foot below the bottom and side slopes of the excavation. Relieve the hydrostatic pressure in pervious zones below the subgrade elevation in layered soils in order to prevent uplift. Use screens and gravel packs as necessary on the dewatering devices to prevent the removal of fines from the soil.

D. Operation and Performance: Operate the dewatering system continuously, 24-hours per day, 7-days per week until construction work below existing water levels is complete. Measure and record the performance of the dewatering system at the same time each day by use of observation wells and piezometers installed in conjunction with the dewatering system. After placement of initial slabs and backfill, the water level may be allowed to rise but at no time allow it to rise higher than one foot below the prevailing level of excavation or backfill. Have a back-up pump and system available for immediate use.

E. Protection and Restoration of Surfaces: Protect newly graded areas from traffic, erosion, and settlements. Repair and reestablish damaged or eroded slopes, elevations or grades and restore surface construction prior to acceptance. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of straw bale dikes, filter fabric dams as indicated on the drawings or as required for good construction practices and to meet all environmental regulations.

1. Disposal of Excavated Material: Dispose of excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger a partly finished structure, impair the efficiency or appearance of facilities, or be detrimental to the completed work.
2. Disposal of Rock. Remove all excess rock off-site.

3.2 SURFACE PREPARATION

A. Erosion Control: Perform as specified in Section 313000, "Erosion and Sedimentation Control Measures".

B. Stockpiling Loam: Strip approved loam to a depth of 4 to 6-inches from the site where excavation or grading is indicated and stockpile separately from other excavated material. Stockpiled loam shall the Contractor's property. Locate loam so that the material can be used readily for the finished grading. Protect and store in segregated piles until needed.

C. Unsatisfactory Material: Remove organic matter, sod, muck, rubbish, and unsuitable soils under embankments, which are less than 3-feet in thickness and under pavements or slabs on grade. Typical depth of removal of such unsuitable material shall be 18 inches unless otherwise indicated.

D. Subgrade Proof Rolling: Proofrolling of subgrade soils shall be done only as noted on project drawings and with authorization of the Architect/Engineer. Proof rolling shall be done in the presence of the Architect/Engineer. Perform proof rolling only when weather conditions permit. Do not proof roll wet or saturated subgrades. Wet or saturated materials degraded by unauthorized proof rolling shall be replaced by the Contractor as directed by the Architect/Engineer at no cost to the Owner. Notify the Architect/Engineer 2-days prior to proof rolling.

3.3 EXCAVATION

A. Excavate to the contours and dimensions indicated. Keep excavations free from water while construction is in progress. Notify the Architect/Engineer immediately in writing in the event that it becomes necessary to remove rock, hard material, or other material defined as unsatisfactory to a depth greater than indicated and an adjustment in contract price will be considered in accordance with the General Conditions. Refill excavations cut below the depths indicated with granular fill and compact as specified herein. Excavate soil disturbed or weakened by the construction operations or soils soften from exposure to weather. Refill with granular fill and compact as specified herein.

B. Excavations for Structures and Spread Footings: Excavate to depth indicated on the drawings. If excavation is deeper than indicated on the drawings, then backfill with compacted structural fill to top of subgrade elevation prior to form placement. Lean concrete shall be used in place of compacted structural fill if backfill is over excavated sound rock as indicated on drawings.

C. Rock: Remove rock to the elevations indicated by drilling, blasting, or approved methods in such a manner that will leave foundation rock in an unshattered and solid condition. Roughen level surfaces and cut sloped surfaces into benches for bonding with concrete. Protect shale from conditions causing decomposition along joints or cleavage planes and other types of erosion. Removal of rock beyond the lines and grades indicated unless previously authorized by the Architect/Engineer will not be grounds for a claim for additional payment.

1. Use of Explosives: When explosives are necessary the Contractor shall use the utmost care not to endanger life or property, including new work. The Contractor shall be responsible for all damage and claims resulting from the use of explosives.

a. Blasting activities should be done in conformance with the "U.S. Department of Interior Rules 816.61-68" and the Blasting Guidance Manual", Office of Surface Mining, Reclamation and Enforcement, U.S. Department of Interior (OSMRE).

b. A blasting plan shall be prepared by the blasting contractor PRIOR to the commencement of the blasting operation. The blasting plan shall include sketches of the proposed drill patterns, delay periods, and decking, and shall indicate the type and amount of explosives to be used, and the location and general description of the structures to be protected.

c. Design standards for the blasting plan shall be as follows:

SOUND	
Lower Frequency Limit (Hz)	Max Level (dB)
0.1 or Lower	134 Peak
2 or Lower	133 Peak
6 or Lower	129 Peak
SEISMIC	
Distance from Blast (ft)	Max PPV in/sec*
0 to 300	1.25
301-5000	1.00
>5000	0.75

*at structures not owned by the Owner

d. A blasting plan shall be prepared by the blasting contractor and the plan shall be published in a newspaper of general circulation in the locality of the site at least 10 but no more than 30 days prior to commencement of the blasting. Copies of the schedule shall be disturbed to local governments and public utilities and to each local residence within 1/2 mile of the site and shall include the following:

1) *Name, address and telephone number of blaster
2) *Identification of the specific areas in which blasting will take place.
3) *Dates and time of blasts
4) *Methods to be used to control access to the area in which blasting is anticipated.

e. The Owner shall provide the Engineer with a photographic/video survey of every structure within 500 feet of the blast zone including but not limited to: building foundations, sign bases, storm and sewer manholes. A survey will be made of each building with the use of a video camera and digital still camera (5 megapixel min.) where applicable. A standard pre-blast form will be utilized and placed on file when the survey is complete.

f. Prior to initiation of blasting, wells within the 500-foot radius of anticipated blasting areas will be sampled and tested from coliform bacteria, nitrate, fluoride, chloride, hardness, copper, iron, and if iron is detected, pH and manganese. Records of the water test results will be placed on file for future reference. This test shall be provided by the Owner.

g. Any site where there are electric blasting caps or where explosive charges are being placed or have been placed shall be designated a Blasting Zone. A Blasting Zone shall be marked by approved sign in accordance with MUTCD. The signs shall be conspicuously placed at each end of the Blasting Zone and shall remain in place only while blasting conditions are in effect and shall be removed after the blast and after all caps and explosives have been removed from the area.

h. All persons and adjacent property within the danger zone of blasting operations shall be warned by the Contractor and no blasting shall be done until the zone is cleared. Sufficient flaggers, furnished by the Contractor, shall be stationed outside the danger zone to stop all approaching traffic during the blasting operations.

i. Before blasting, the Contractor shall have adequate equipment available to remove debris from the traveled way to restore normal traffic flow with a minimum of delay.

j. A seismograph shall be set up at buildings which lie within a 300 foot radius of the blasting activities. The seismograph shall have a Seismic Frequency Range of 2 to 150 Hertz and a sound frequency of 2-500 Hz. It shall be capable of recording longitudinal, transverse, vertical and resultant peak particle motion. The following information shall be printed out for each blast:

1) Instrument Type
2) Instrument Calibration Date
3) Date and Time of Blast
4) Instrument Location
5) Distance to Blast
6) Resultant Peak Particle Velocity
7) Seismograph Operator
8) Airblast (dB)

k. The seismograph shall be used to determine the air blast and peak article velocity of each shot in the area where the seismograph is set. Peak particle velocities recorded within the 300-foot radius which exceed 1.25 in/sec. shall be reported to the blaster and the Owner as soon as the record is available.

l. Watchmen shall be provided by the Contractor during the loading period and until the charges have been exploded.

D. Shoring and Sheeting: Where required, shore and sheet excavations as described in the submitted plan, with various members sized and arranged to prevent injury to persons and damage to structures. Also arrange shoring and sheeting to preclude injurious caving during removal.

3.4 BORROW MATERIALS

A. Select borrow materials to meet requirements and conditions of the particular fill or backfill materials to be used. Obtain borrow materials from sources off of Owner property.

3.5 FILLING AND BACKFILLING

A. Subgrade Preparation: Step, bench, or break up sloped surfaces steeper than one vertical to 4-horizontal so that the fill material will bond with or be securely keyed to the existing material. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

B. Fill and Backfill Beside Structures: Place required backfill material adjacent to structures and compact in a manner that prevents wedging action or eccentric loading upon or against the structures. Step or serrate slopes bounding or within areas to be backfilled to prevent sliding of the fill. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Do not place material on surfaces that are muddy, frozen, or contain frost. Do not use equipment for backfilling operations or for the formation of embankments against structures that will overload the structure. Backfilling against concrete will be done only after the concrete has attained at least 70% of its 28-day compressive strength and approval has been obtained from the Architect/Engineer.

C. Structural Fill: Place structural fill under spread footing, concrete slabs not pile supported, and pavements in loose lifts of 9-inches maximum. Do not place material on surfaces that are muddy, frozen, or contain frost. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified herein before placing the overlaying lift. Compaction shall be accomplished continuously over the entire area. Sufficient passes shall be made to ensure that specified density is obtained.

D. General Site Fill: Construct site fill, at the locations and to lines and grades indicated on the drawings. Use only approved materials in constructing fill upon the prepared subgrade. Place satisfactory material in horizontal lifts not exceeding 18-inches in loose depth. Do not place material on surfaces that are muddy, frozen, or contain frost. Compact with equipment well suited to the soil being compacted. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each lift as specified before placing the overlaying lift.

E. Final Backfill for Utilities: Construct backfill (final backfill) and general site fill for storm drains, manholes, utility lines, and other utility appurtenances using the material and compaction requirements specified herein for the adjacent or overlaying work. Bedding and initial backfill requirements are specified in Section 312100, "Earthwork for Utilities". Backfilling against concrete shall be done only after the concrete has attained at least 70% of its 28-day compressive strength and approval has been obtained from the Architect/Engineer.

F. Fill for Coarse Aggregate Under Slab: Place material over compacted subgrade. Compact and test the material. Then install the vapor barrier. Then install, compact and test the upper layer of material.

G. Weather Limitations: Fill and backfill shall not be constructed when weather conditions detrimentally affect the quality of the finished course. Place fill and backfill only if the atmospheric temperature is above freezing in the shade and is rising. Do not construct fill and backfill in the rain or on saturated subgrades. If weather conditions are windy, hot or arid, with high rate of evaporation, schedule the placement in cooler portions of the day and furnish equipment to add moisture to the fill or backfill during and after placement.

3.6 SUBGRADE GEOTEXTILE FABRIC (For Sloped/Flat Surfaces)

A. Place synthetic fiber geotextile fabric as indicated on drawings and as specified directly on prepared subgrade free of vegetation, stumps, and rocks larger than 2-inches diameter and other debris, which may puncture or otherwise damage the fabric. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of Two (2)-feet overlap in all directions. Overlap fabric at joints a minimum of two feet. Obtain approval of geotextile fabric installation before placing fill or backfill. Place fill or backfill on fabric in the direction of overlaps and compact as specified herein. Follow manufacturers recommended installation procedures.

3.7 COMPACTION

A. Compact each layer or lift of material specified so that the in-place density tested is not less than the percentage of maximum density specified. General fill below grassed areas shall be compacted to at least 90% of its maximum dry density as determined by ASTM D1557. Fill materials for all other areas shall be compacted to at least 95% of ASTM D1557 unless otherwise noted.

3.8 RESTORATION

A. Site Grading: Grade to finished grades indicated within 0.10-foot. Grade areas to drain water away from structures. Existing grades, which are to remain but are disturbed by the Contractor's operations shall be restored as directed by the Architect.

B. Finishing Subgrades Under Structures and Pavements: Finish the surface of top lift of fill or top of subgrade to the elevation and cross section indicated on the drawings. Finished surface shall be smooth and of uniform texture. Lightly scarify or blade the finished surface to bring the finished surface to within 0.05-foot of the indicated grade and to eliminate imprints made by compaction and shaping equipment. Surface shall show no deviations in excess of 3/8-inch when tested with a 10-foot straightedge.

C. Disposition of Surplus Material: Surplus or other soil material not required or suitable for filling, backfilling, or embankment shall be removed from Owner's property. Comply with the requirements of applicable environmental requirements.

D. Protection of Surfaces: Protect newly graded areas from traffic, erosion, and settlements that may occur in compliance with all applicable environmental regulations and as specified in the paragraph entitled "Protection and Restoration of Surfaces". Repair or reestablish damaged grades, elevations, or slopes prior to acceptance of work.

3.9 FIELD QUALITY CONTROL

A. All testing shall be performed by a qualified Independent Testing Laboratory acceptable to the Engineer and General Contractor at the Owner's expense unless otherwise indicated (see Section 014000 - Quality Requirements).

B. In addition to the above tests, the Independent Testing Laboratory will perform additional density tests at locations and times requested by the Engineer.

C. Additional density testing will be required by the Engineer if the Engineer is not satisfied with the apparent results of the Site Contractor's compaction operation.

1. If the test results fail to meet the requirements of these specifications, the General Contractor shall undertake whatever action is necessary, at no additional cost to the Owner, to obtain the required compaction. The cost of retesting will be paid by General Contractor.
2. If the test results pass and meet the requirements of these Specifications, the cost of the initial testing service will be borne by the Owner, but no additional cost will be considered for delays in the performance of the work.

D. Tests: Test fill, granular base, backfill, granular subbase, granular fill and coarse aggregate as specified herein and as follows:

1. For gradation (sieve analysis) fine and course, as per ASTM C136 and D422.
2. For moisture density as per ASTM D1557.

Also perform tests as per Table IV.

For areas under slab on grade: First, nuclear density test the granular fill material under the vapor barrier as per ASTM D6938. Then density test the granular fill which is installed between the slab and the vapor barrier.

TABLE IV
TESTS

Material Type	Location of Material	Minimum Field Density Test Frequency
Fills and Backfills	Structures (adjacent to)	One test per side of structure per lift.
Controlled Fills	Primary roadways and structures (under)	One test per lift per 2,000 sq. ft.
Embankments of Borrow	Any	One test per lift per 10,000 sq. ft.
Borrow	Any	One test per lift per 10,000 sq. ft.

—End of Table IV—

3. If the gradation test results fail to meet the requirements of the specifications, or if the sample is noticeably different when delivered to the site, or if the stockpile source changes either before or during construction, or if compaction of the material is unable to meet the compaction requirements, the General Contractor shall undertake whatever action is necessary, at no additional cost to the Owner, to obtain the required gradation. The cost of the retesting will be paid by the General Contractor.

a. Additionally the contractor reserves the right to test the material for proper gradation in advance of the project's notice to proceed, however the owner reserves the right to request the material be retested once the materials has arrived on site, especially including but not limited to if one of the following has occurred; more than 3 months have passed since the initial material testing had been done, if the material arriving on site for placement appears to not meet spec, if the supplier stockpile has been reworked or if the stockpile supplier has changed, or if mixing of on-site stockpiles has occurred, or other similar occurrences which may affect the products integrity or as noted above. The contractor incurs the cost of this additional testing.

E. Structural Fill: Method of in-place density tests shall be in accordance with paragraph "Tests". Acceptance of the compacted material shall be determined in each location by the results of a minimum of two consecutive tests. The average of two tests shall equal or exceed the specified density. The location of the tests for each compacted layer will be randomly selected by the Architect/Engineer.

1. Acceptance: The average of field density test results in each fill area shall meet or exceed the specified density requirements and no individual test shall be more than 3% below specified density.

END OF SECTION 312000

SECTION 312100 – EARTH MOVING FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes performing site preparation, excavation, borrow, filling, backfilling, compaction, compaction testing, and finish grading necessary to construct to the specified finished grades indicated for utilities. The work covered by this section shall terminate at a point approximately 10 feet from the building, unless otherwise indicated on the drawings.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities procedures.
2. Division 01 Section "Temporary Tree and Plant Protection" for protecting trees remaining on-site that are affected by site operations.
3. Division 32 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.
4. Division 31 Section "Earth Moving for Pavements and Structures" for soil materials, excavating, backfilling, and site grading.
5. Division 31 Section "Dewatering" for requirements and guidelines for dewatering procedures.
6. Division 31 Section “Excavation Support and Protection" for requirements and guidelines for dewatering procedures.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C33	2008 Standard Specification for Concrete Aggregates
ASTM D698	2007 (Rev. 1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
ASTM D1556	2007 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	2007 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

ASTM D1586 2008 (Rev. A) Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

ASTM D6938 2008 Rev. A) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

ASTM D4253 2000 (Rev. 2006) Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table

ASTM D4254 2000 (Rev. 2006, E1) Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

ARMY CORPS OF ENGINEERS (COE) WATERWAYS EXPERIMENT STATION

COE EM-385-1-1 2008 Safety and Health Requirements Manual

FEDERAL SPECIFICATIONS (FS)

FS UU-P-268 1977 (Rev. G) (Amd. 3) Paper, Kraft, Wrapping

STATE OF MAINE, DEPARTMENT OF TRANSPORTATION

State of Maine, Department of Transportation MDOT Standard Specifications, 12/2002 and amendments

B. Materials and workmanship specified herein with reference to MDOT State Standard shall be in accordance with the referenced articles, sections, and paragraphs of the standard except that contractual and payment provisions do not apply.

1.4 DEFINITIONS

A. Backfill: Material used in refilling a cut, trench or other excavation.

B. Cohesive Materials: Soils classified by ASTM D2487 as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when fines have a plasticity index greater than zero.

C. Cohesionless Materials: Soils classified by ASTM D2487 as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

D. Compaction: The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of Compaction" is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D698 or ASTM D1557 for general soil types or ASTM D4253 or ASTM D4254 (Relative Density) for isolated cohesionless materials, abbreviated in this specification as " _____ percent ASTM D1557 maximum density."

E. Pipe Bedding: A dense, well-graded aggregate mixture of sand, or coarse aggregate, as indicated (mixed individually, in combination with each other, or with suitable binder soil) placed on a subgrade to provide a suitable foundation for pipe.

F. Hard Material: Weathered rock, dense consolidated deposits, or conglomerate materials (excluding man made materials such as concrete) which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

Material indicated in the soil boring logs as having a standard penetration resistance as determined by ASTM D1586 between 60 and 120 blows per foot is arbitrarily defined herein as "Hard Material".

G. In-Situ Soil (Undisturbed Earth): Existing in place soil.

H. Lift: A layer (or course) of soil placed on top of subgrade or a previously prepared or placed soil in a fill or backfill.

I. Porous Fill: A granular soil material having a large void ratio when placed and compacted, allowing a free flow of fluid to or from the surrounding soil, with no more than 5% of the material passing the 1/2-inch No. 100 Sieve.

J. Refill: Material placed in excavation to correct overcut in depth.

K. Rock: Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding three (3) cubic yard in volume. Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production. Material identified in the soil boring logs as having a standard penetration resistance as determined by ASTM D1586 greater than 120 blows per foot is arbitrarily defined herein as "Rock."

L. Loam: In natural or undisturbed soil formations, the fine-grained, weathered material on the surface or directly below any loose or partially decomposed organic matter. Loam may be a dark-colored, fine, silty, or sandy material with a high content of well decomposed organic matter, often containing traces of the parent rock material. Gradation and material requirements specified herein apply to all Loam references in this contract. The material shall be representative of productive soils in the vicinity.

M. Unyielding Material: Rock rib, ridge, rock protrusion, or soil with cobbles in the trench bottom requiring a covering of finer grain material or special bedding to avoid bridging in the pipe or conduit.

N. Unsatisfactory Material: In-Situ soil or other material, which can be identified as having insufficient strength characteristics or stability to carry intended loads in the trench without excessive consolidation or loss of stability. Also backfill material, which contains refuse, frozen material, large rocks, debris, soluble particles, and other material, which could damage the pipe or cause the backfill not to compact. Materials classified as PT, OH, or OL by ASTM D2487 are unsatisfactory.

O. Unstable Material: Material in the trench bottom, which lacks firmness, to maintain alignment and prevent joints from separating in the pipe, conduit, or appurtenance structure during backfilling. This may be material otherwise identified as satisfactory which has been disturbed or saturated.

1.5 SUBMITTALS

A. Factory Test Reports (produced within the past year)

1. Trench backfill material tests
2. Pipe bedding material tests

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver and store materials in a manner to prevent contamination, segregation, freezing, and other damage. Store synthetic fiber filter fabric to prevent exposure to direct sunlight.

1.7 CRITERIA FOR BIDDING

A. Base bids on the following criteria:

1. Surface elevations are as indicated. If not indicated, verify in the field.
2. Pipes or other man-made obstructions, other than those indicated, could be encountered. Field verify existing conditions.
3. The character of the material to be excavated or found in the trench is as indicated. If not indicated, field verify. In addition to rock as indicated and as defined in paragraph entitled "Definitions," hard material in the form of conglomerate clay, sand, silt, gravel, volcanic tuff, or consolidated calcareous marine sediments could be encountered. Remove such hard material to the lines and grades indicated regardless of the hardness or quantity. Such material shall not be considered rock.
4. Removal of rock to the lines and grades as required shall be done at the unit price on the bid form for "Mass or Trench Excavation". The unit price shall include all of the site contractors' costs associated with rock removals including but not limited to: watchmen; signage; video/preblast surveys; water quality samples.
5. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
6. Borrow material, Suitable backfill, and bedding material in the quantities required is not available at the project site.
7. Blasting will be permitted. Obtain /Architect/Owner's prior permission.

1.8 PROTECTION

A. Utilities: Movement of construction machinery and equipment over pipes and utilities during construction shall be at the contractor's risk. Perform work adjacent to utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Architect/Engineer. Report damage to utility lines or subsurface construction immediately to the Architect/Engineer.

1.9 ADDITIONAL REQUIREMENTS

A. Local Standards: All water line and sewer work shall meet local municipal standards, and local utility company standards; furnish written evidence that such standards have been met.

B. Road Crossings: Contractor to obtain and pay for all required road crossing permits (including MDOT and local areas when required). Perform all work for street resurfacing which is required for such permits.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Provide soil materials as specified below free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, ice, or other deleterious and objectionable materials.

B. Backfill: Bring trenches to grade indicated on the drawings using material excavated on the site of this project. When at all possible provide borrow as necessary. Borrow shall be in accordance with backfill requirements of this paragraph and approved for use by the Architect/Engineer prior to placement. This material will be considered unclassified and no testing other than for compaction will be required before use as backfill classified as GW by ASTM D2487 with a maximum particle size of 3-inches conforming to gradation MDOT 703.06.

C. Special Backfill for Structures and Pavements: Backfill trenches under roads, structures, and paved areas as specified in Section 312000, "Earth Moving For Structures and Pavements" with material conforming to MDOT 703.06.

D. Sand: Sand shall consist of natural sand or, when approved by the Architect, other inert materials with similar characteristics or combinations thereof, having strong, durable particles. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile nor used alternately in the same class of construction or mix without permission of the Architect. All sand shall be free from injurious amounts of organic impurities. Should the sand, when subjected to the calorimetric test for organic impurities, AASHTO T21 (ASTM C40), produce a color darker than the reference standard color solution (laboratory designation Plate III), it shall be rejected. The sand shall be well graded from coarse to fine and shall meet the following grading requirements when tested according to AASHTO T11 and AASHTO T27.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves
3/8 inch	100
No. 4	95-100
No. 8	70-95
No. 16	45-80
No. 30	25-55
No. 50	10-30
No. 100	2-10
No. 200	0-5

E. Backfill for Underdrainage Systems - Refer to Section 334200.

F. Borrow: Provide materials meeting requirement for general site fill. Obtain borrow materials in excess of those furnished from excavations specified herein from sources off Owner property.

G. Pipe Bedding: Provide material for pipe bedding as indicated.

2.2 GENERAL SITE FILL, BACKFILL AND EMBANKMENT MATERIAL

A. Provide a soil material from the site or borrow that can be readily compacted to the specified densities. Materials shall be free of organic material, peat, clay, and other similar soft materials.

2.3 LOAM

A. Loam shall be as covered in Section 329200 - "Turf and Grasses."

2.4 GRANULAR FILL

A. Granular fill shall be as covered in Section 312000, "Earth Moving for Structures and Pavements".

2.5 CONCRETE PIPE CRADLES (THRUST BLOCKS) OR ARCHES

A. Provide concrete pipe, cradles (thrust blocks) where indicated on the drawings and where unstable conditions are encountered conforming to lines and dimensions indicated. Provide concrete in accordance with Section 033000, "Cast-In-Place Concrete." with the concrete having a 28-day compressive strength of 3,000 psi minimum.

2.6 BURIED WARNING AND IDENTIFICATION TAPE

A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3-inch-minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil. Typical Warning Tape Color Codes (Refer to drawings for type needed)

Yellow:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

B. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

C. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.7 MATERIAL FOR RIP-RAP

A. Bedding material, Filter fabric, and rock conforming to these requirements and as indicated.

B. Bedding Material: Consisting of sand, gravel, or crushed rock, well graded, with a maximum particle size of 2 inches. Material shall be composed of tough, durable particles. Fines passing the No. 200 standard

sieve shall have a plasticity index less than six. Refer to Section 312000, "Earth Moving for Structures and Pavements" for stone materials and bedding materials requirements.

C. Rock: Rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. The size of the fragments shall be such that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Specific gravity of the rock shall be a minimum of 2.50. The inclusion of more than trace 1% quantities of dirt, sand, clay, and rock fines will not be permitted. The rock shall be either crushed rock or angular quarried stone. No round or thin, flat stones will be permitted. Rock shall be in its angular state nearly rectangular in cross-section as practible.

D. Refer to Section 313000, "Sediment and Erosion Control Measures" for filter fabric requirements.

2.8 HEAVY RIP RAP

A. Shall conform to Maine DOT 703.28 and as follows

1. Stones shall consist of sound, durable rock, resistant to the action of air and water. Either field stone or rough, unhewn quarry stone may be used. The exposed stones shall be angular. Round or thin, flat stones will not be permitted. Stones shall have a minimum weight of 500 pounds each and at least 50% of the stones, by volume, shall exceed 1,000 pounds.
2. Filter fabric and bedding shall conform as indicated or as described for regular rip rap included in this specification section.

2.9 FLOWABLE FILL

A. Description: This section specifies the requirements for flowable fill used for trenches, support for pipe structures, culverts, utility cuts and other works where cavities exist and where firm support is needed for pavements and structural elements. Flowable fill may also be used to fill abandoned water and sewer lines, abandoned fuel tanks, and where any granular compacted fill is needed as is approved by the Engineer or where otherwise shown on the plans or as specified.

B. Consisting of the placement of a flowable material consisting of portland cement (Type I, II, or III ASTM C150) , fly ash (ASTM C618) and/or sand with an expected 28 day unconfined compressive strength of more than 50 pounds per square inch but less than 100 pounds per square inch. Fine aggregate shall be natural sand or sand manufactured from stone, gravel or air-cooled blast furnace slag. The mixture shall consist of: 50 lbs/CY Cement; 250 lbs/CY Fly Ash; 2,910 lbs/CY sand; and 500 lbs/CY water. The sand shall be fine enough to stay in suspension in the mixture to ensure proper flow. These mixtures of materials are expected to yield approximately one cubic yard of material of a flowable consistency. Small adjustments in the amounts of the materials in a mix may be required to achieve the final product. No additional compensation for a change in the material blends shall be allowed. The Contractor shall make one or more one cubic meter (cubic yard) trial batches at different water contents to ensure a flowable material. The mixture is too dry when cracks develop in the fixture as it flows into place.

C. Adjustments of the proportions shall be based on maintaining the total absolute volume. In order to expedite the settlement of a mixture without entrained air, it may be necessary for bleed water to appear on the surface immediately after the material is struck off. A delay in bleeding indicates there are too many fines in the mixture. The fly ash quantity may be reduced in increments of 50 pounds until

the mixture is bleeding freely. Approximately 60 pounds of sand shall be added to replace each 50 pounds increment of fly ash to maintain the original yield.

D. Other mixes may be submitted to the Architect/ Engineer for approval. The Contractor shall submit the mix design and test data from an independent test lab 30 days prior to the intended usage for approval. All alternate mixes shall have an unconfined compressive strength between 50 and 100 pounds per square inch at 28 days when tested in accordance with ASTM D 4832. The long term 12 month unconfined compressive strength shall be less than 100 pounds per square inch.

E. The final mix shall have the required strength, fill the voids of the intended usage and set up within 12 hours. The proportioning, yield, consistency, workability, compressive strength and all other requirements are the sole responsibility of the Contractor.

PART 3 - EXECUTION

3.1 PROTECTION

A. Shoring and Sheeting: Provide shoring bracing, underpinning and sheeting where indicated or where required to perform work. In addition to Section XXIII A and B of COE EM-385-1-1, include provisions in the shoring and sheeting plan that will accomplish the following:

1. Prevent undermining of pavements, foundations and slabs.
2. Prevent slippage or movement in banks or slopes adjacent to the excavation.
3. When used, allow for the abandonment of shoring and sheeting materials in place in critical areas as the work is completed. In these areas, backfill the excavation to within 3 feet of the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.

B. Dewatering: Plan for and provide the structures, equipment, and construction for the collection and disposal of surface and subsurface water encountered in the course of construction.

C. Water Removal: Remove water by pumping or other methods to prevent the softening of surfaces exposed by excavation, prevent hydrostatic uplift, and provide a stable trench condition for installation of the utility. Use screens and gravel packs or other filtering systems on the dewatering devices to prevent the removal of fines from the soil.

D. Operation and Performance: Operate the dewatering system continuously 24 hours a day, 7 days per week until construction work below existing water levels is complete. Measure and record the performance of the dewatering system at the same time each day with observation wells and piezometers installed in conjunction with the dewatering system. After placement of the pipe or conduit and the initial backfill, the water level may be allowed to rise but at no time allow it to rise higher than one foot below the prevailing level of excavation or backfill. Have a back-up pump and system available for immediate use.

1. Structures and Surfaces: Protect newly backfilled areas and adjacent structures, slopes, or grades from traffic, erosion settlement, or any other damage. Repair and reestablish damaged or eroded grades and slopes and restore surface construction prior to acceptance. Protect existing streams, ditches, and storm drain inlets from water-borne soil by means of straw bale dike as indicated on the contract drawings and as required for good construction practices.

3.2 SURFACE PREPARATION

A. Stockpiling Loam: Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as loam shall be stockpiled and used for backfilling. Locate loam so that the material can be used readily for the finished grading. Where sufficient existing loam conforming to the material requirements is not available on site, provide borrow materials suitable for use as loam. Protect loam and keep in segregated piles until needed.

B. Cutting Pavement and Curbs: Saw cut with neat, parallel, straight lines one foot wider than trench width on each side of trenches and one foot beyond each edge of pits. When the saw cut is within three (3) feet of an existing joint, remove pavement to the existing joint.

3.3 GENERAL EXCAVATION AND TRENCHING

A. Keep excavations free from water while construction is in progress. Notify the Architect immediately in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material to a depth greater than indicated. Make trench sides as nearly vertical as practicable except where sloping of sides is allowed. Sides of trenches shall not be sloped from the bottom of the trench up to the elevation of the top of the pipe, conduit, or duct. Excavate ledge rock, boulders, and other unyielding material to an overdepth at least 6 inches below the bottom of the pipe, conduit, or duct and appurtenances unless otherwise indicated or specified. Overexcavate soft, weak, or wet excavations. Use bedding material placed in 6-inch-maximum layers to refill overdepths to the proper grade. At the Contractor's option, the excavations may be cut to an overdepth of not less than 4 inches and refilled to required grade as specified. Grade bottom of trenches accurately to provide uniform bearing and support for each section of pipe, conduit, duct, structure on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Dig bell holes and depressions for joints after trench has been graded. Dimension of bell holes shall be as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated or as required to properly perform the work.

B. Shoring and Sheeting: Shore and sheet excavations as described in the plan submitted with various member sizes arranged to prevent injury to persons and damage to structures. Arrange shoring and sheeting to preclude injurious caving during removal. Obtain approval from the Architect prior to removing shoring, sheeting, or bracing in excavations adjacent to on-grade slabs, foundations, or other structural elements.

3.4 BEDDING

A. Of materials and depths as indicated or specified for utility lines and utility line structures. Place bedding in 6-inch- maximum loose lifts. Provide uniform and continuous support for each section of structure except at bell holes or depressions necessary for making proper joints.

B. Concrete Cradles: Specified in lieu of other types of bedding for a particular type of pipe material, shall be as specified.

3.5 BURIED WARNING AND IDENTIFICATION TAPE

A. Install tape in accordance with manufacturer's recommendations except as modified herein. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.6 BACKFILLING

A. Construct backfill in two operations (initial and final) as indicated and specified in this section. Place initial backfill in 6-inch-maximum loose lifts to one foot above pipe, conduit, or duct unless otherwise specified. Ensure that initially placed material is tamped firmly under pipe haunches. Bring up evenly on each side and along the full length of the pipe, conduit, or duct structure. Ensure that no damage is done to the utility or its protective coating. Place the remainder of the backfill (final backfill) in 9-inch-maximum loose lifts unless otherwise specified. Compact each loose lift as specified in the paragraph entitled "General Compaction" before placing the next lift. Do not backfill in freezing weather or where the material in the trench is already frozen or is muddy, except as authorized. Provide a minimum cover from final grade as indicated. Where settlements greater than the tolerance allowed herein for grading occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Examples of testing that shall be complete before final backfilling are as follows: water distribution, storm drainage, sanitary sewer, gas distribution systems. Provide buried warning and identification tape installed in accordance with the manufacturer's recommendation.

3.7 COMPACTION

A. Use hand-operated, plate-type, vibratory, or other suitable hand tampers in areas not accessible to larger rollers or compactors. Avoid damaging pipes and protective pipe coatings. Compact material in accordance with the following unless otherwise specified. If necessary, alter, change, or modify selected equipment or compaction methods to meet specified compaction requirements.

B. Compaction of Material in Subcuts or Overexcavations: In rock, compact to 95 percent of ASTM D1557 maximum density. In soft, weak, or wet soils, tamp refill material to consolidate to density of adjacent material in trench wall. In stable soils, compact to 90 percent of ASTM D1557 maximum density.

C. Compaction of Pipe and Conduit Bedding: In rock, compact to 95 percent and in soil, compact to 90 percent of ASTM D1557 maximum density.

D. Compaction of Backfill: Compact initial backfill material surrounding pipes, cables, conduits, or ducts, to 90 percent of ASTM D1557 maximum density except where bedding and backfill are the same material. Where bedding and backfill are the same material, compact initial backfill to the density of the bedding. Under areas to be seeded or sodded, compact succeeding layers of final backfill to 85 percent of ASTM D1557 maximum density. For utilities under highway right-of-way, structures and pavements compact succeeding layers of final backfill as specified under paragraph entitled "Special Earthwork Installation Requirements" or compact succeeding layers of final backfill as specified under section 312000 “Earthwork for Structures and Pavements", whichever is the more stringent.

E. Flowable Fill Placement: Sufficient mixing capacity and delivery equipment shall be provided for the material to be placed without interruption as much as practical. Flowable fill shall be produced and delivered using standard concrete construction equipment and practices. The mixture shall be discharged within 2.5 hours after the water is added. Placing flowable fill shall be by chute, pumping, or other method approved by the Engineer into the space of the plan intended usage. The fill material shall be brought up uniformly to the fill line shown on the plans or as directed by the Architect/Engineer. Placing of the other fill material over low strength mortar backfill material may commence as soon as the surface water is gone or as directed by the Architect/Engineer. The Architect/Engineer reserves the right to reject the mix if a flowable mixture is not produced.

Before placing the low strength mortar backfill as backfill for conduit or sleeves, the Contractor shall secure the conduit or sleeve to prevent it from floating during placement of the flowable material.

Flowable fill limitation of operation: No flowable fill shall be placed on frozen ground. Mixing and placing of the material is acceptable in freezing temperatures. At the time of placement the flowable fill shall have a temperature of at least 40 degrees F. When flowable fill is placed in freezing temperatures, the material should be covered with blankets overnight. When paving over flowable fill in cold weather, any frozen material on the surface can be scraped off and removed prior to paving.

The flowable fill shall be left undisturbed until the material obtains sufficient strength. Sufficient strength for paving is achieved when the flowable fill can support the weight of foot traffic without apparent deformation. Sufficient strength for supporting vehicular traffic is 2.5 tons per square foot as measured by a pocket penetrometer.

3.8 SPECIAL EARTHWORK INSTALLATION REQUIREMENTS

A. Manholes and Other Appurtenances: Provide at least 12 inches clear from outer surfaces to the embankment or shoring. Remove rock as specified herein. Remove unstable soil that is incapable of supporting the structure to an overdepth of one foot and refill with coarse aggregate to the proper elevation. Stabilize soft, weak, or wet excavations. Refill overdepths with coarse aggregate to the required grade and compact to 95% unless indicated otherwise on drawings.

B. Compaction for Structures and Pavements: Place final backfill in 6-inch-maximum loose lifts. If a vibratory roller is used for compaction of final backfill, the lift thickness can be increased to 9 inches. Compact all backfill surrounding pipes, ducts, conduits, and other structures to 95 percent of ASTM D1557 maximum density and compact the top 12 inches of subgrade to 95 percent of ASTM D1557 maximum density. Backfill to permit the rolling and compacting of the completed excavation with the adjoining material, providing the specified density necessary to enable paving of the area immediately after backfilling has been completed.

3.9 RIP-RAP CONSTRUCTION

A. Construct rip-rap as indicated and as follows.

1. Preparation: Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.l foot.

B. Bedding Placement: Spread filter fabric and bedding material uniformly to a thickness of at least 3 inches on prepared subgrade or as indicated. Finish bedding to present even surface free from mounds and windows.

C. Stone Placement: Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.10 FINISH OPERATIONS

A. Grading: Finish to grades indicated within one-tenth of a foot. Provide sod or loam in areas to be seeded or sodded as indicated and in accordance with requirements specified in Section 329200, "Turf and Grasses." Grade areas to drain water away from structures and to provide suitable surfaces for mowing machines. Grade existing grades that are to remain but have been disturbed by the Contractor's operations.

B. Spreading Loam: Clear areas to receive loam for the finished surface of materials that would interfere with planting and maintenance operations. Scarify subgrade to a depth of 2 inches. Do not place loam when the subgrade is frozen, extremely wet or dry, or in other conditions detrimental to seeding, planting, or grading. Comply with the requirements of Section 329200, "Turf and Grasses." Spread loam to a uniform depth of 4 inches over the designated areas.

C. Disposition of Surplus Material: Surplus or other soil material not required or suitable for filling, backfilling, or grading shall be removed from Owner's property unless otherwise noted or directed in writing. Comply with all environmental requirements.

D. Protection of Surfaces: Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

E. Pavement Repair: Repair pavement, curbs, and gutters as indicated and as required. Do not repair pavement until trench or pit has been backfilled and compacted as specified herein. Provide a temporary road surface of gravel over backfilled portion until permanent pavement is repaired. Remove and dispose of temporary road surface material when permanent pavement is placed. As a minimum, maintain one-way traffic on roads and streets crossed by trenches. Fully open roads and streets to traffic within 1 day.

3.11 FIELD QUALITY CONTROL

A. General Contractor to arrange for and Owner to pay for all soils and field testing. The General Contractor shall pay for any required retesting by the Architect and Owner.

B. Test sand, bedding, backfill, loam, coarse aggregate, granular fill for conformance to specified requirements. Test backfill to be used under roads and paved areas for conformance to special requirements. Test bedding and backfill for moisture-density relations in accordance with ASTM D698, ASTM D1557 as specified herein. Perform at least one of each of the required tests for each material provided. Perform sufficiently in advance of construction so as not to delay work. Provide additional tests as specified above for each change of source. Perform density and moisture tests in randomly selected locations and in accordance with required ASTM numbers as follows:

1. Bedding and Backfill in Trenches: One test per 50 linear feet in each lift.
2. Appurtenance Structures: One test per 100 square feet or fraction thereof in each lift.

Where ASTM D6938 is used to test field compaction densities, verify test results by performing at least one test per day using ASTM D1556 at a location already tested in accordance with ASTM D6938. Perform at least one additional test using ASTM D1556 for every ten tests performed with a nuclear device, at locations checked in accordance with ASTM D6938.

C. The contractor reserves the right to test the material for proper gradation in advance of the project’s notice to proceed, however the owner reserves the right to request the material be retested once the materials has arrived on site, especially including but not limited to if one of the following has occurred; more than 3 months have passed since the initial material testing had been done, if the material arriving on site for placement appears to not meet spec, if the supplier stockpile has been reworked or if the

stockpile supplier has changed, or if mixing of on-site stockpiles has occurred, or other similar occurrences which may affect the products integrity.

END OF SECTION 312100

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes construction dewatering.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.
3. Division 31 Section "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
4. Division 33 Section "Subdrainage" for permanent foundation wall, under floor, and footing drainage and site drainage.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
4. Remove dewatering system when no longer required for construction.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
2. The geotechnical report is included elsewhere in the Project Manual.

B. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Photo Documentation: Digital photo documentation should be made. This includes pre-dewatering, during dewatering, and post-dewatering.

1.6 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, discharge splash pads, control of sediment, including location of temporary settling ponds, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written plan, prepared by a state licensed professional engineer registered in the state the dewatering operations will take place, for dewatering operations including control procedures to be adopted if dewatering problems arise.
3. Site photos of showing conditions before dewatering operations begin. Photos should include items and system parts identified in the dewatering plan and shall show any nearby waterways to be used as comparison should erosion and sediment control problems arise. Site photos shall be submitted before, during and upon the conclusion of dewatering operations. These photos should show discharge of water did not create on-site or off-site erosion and sediment control problems. Including the condition of any nearby waterways

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area. Provide upstream surface water diversion berms and subsurface groundwater diversion underdrains.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls during dewatering operations.

G. Major problems or deficiencies may require construction operations to shut down until the situation has been corrected. If the architect or owner points out a problem or deficiency and the contractor has not made significant attempts to correct the situation, the owner reserves the right to shut down construction operations until the correction has been made and the contractor will not be compensated for lost time or money due to construction stoppage.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

G. Freezing/snow conditions: The contractor should take the proper precautions ensure that none of the dewatering system will be adversely impacted or compromised due to weather such as below freezing temperatures or accumulating snow. The contractor is responsible for removing ice or snow that impacts the dewatering process and their ability to safely discharge the water. This includes checking for snow/ice blockage downstream or off-site of the dewatering discharge point and remedying the situation to ensures the worker and public safety and health.

H. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations in a timely manner.

END OF SECTION 312319

SECTION 313000 - SEDIMENTATION AND EROSION CONTROL MEASURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Establishment and maintenance of temporary and permanent drainage areas.
2. Construction, stabilization and maintenance of temporary construction entrances.
3. Construction and maintenance of temporary and permanent outfalls, swales, waterways and embankments.
4. Temporary and permanent vegetative stabilization.
5. Establishment and maintenance of designated stockpile areas.
6. Construction and maintenance of silt fences, stone check dams and hay bale barriers.
7. All erosion and sediment control work required for the safe conduct of the work, whether or not specifically mentioned in these Specifications or indicated on the Drawings.

B. Related Sections include the following:

1. Division 32 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.
2. Division 31 Section "Site Clearing" for temporary measures required for site clearing.
3. Division 31 Section "Earth Moving for Pavements and Structures" for soil materials, excavating, backfilling, and site grading.
4. Division 31 Section "Earth Moving for Utilities" for soil materials, excavating, backfilling for utilities.

1.3 REFERENCES

A. Quality, grades of materials and installation procedure: In conformance with applicable code and standards including:

1. American Society for Testing and Materials (ASTM).
2. State of Maine, Department of Transportation, Standard Specifications (MDOT) 12/2002.
3. Maine Erosion and Sedimentation Control Handbook for Construction: Best Management Practices 3/2003.

B. Land, Air and Water Pollution: Comply with Pollution Control Standards for the State of Maine applicable to the work to ensure that no pollution is caused by work of this Contract.

C. Soil Erosion and Sediment Control: Implement soil erosion and sediment control in strict accordance with provisions of the Erosion and Sedimentation Control Handbook.

1.4 DEFINITIONS

A. Sediment: Soil and other debris that have eroded and have been transported by runoff water or wind.

B. Dust: Earthy material and any substance reduced to fine powder.

C. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials, except hazardous waste as defined in paragraph entitled "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.

D. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

E. Debris: Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

F. Oily Waste: Petroleum products and bituminous materials.

1.5 SUBMITTALS

A. Factory Test Reports

1. Erosion Control Mesh.
2. Geotextile fabric.
3. Silt Fence.

1.6 ENVIRONMENTAL PROTECTION REQUIREMENTS

A. Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, light, and noise pollution.

B. Environmental Protection Plan: Five days after the award of contract, the Contractor shall meet with the contracting Officer to discuss the proposed environmental protection plan and to develop mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken.

C. Environmental Planning: Fourteen days after the meeting, the Contractor shall submit to the Architect/Engineer the proposed environmental plan for further discussion, review, and approval.

D. Commencement of the Work: As directed by the Contracting Officer, following approval.

E. Tree Protection: See section 015639 Temporary Tree and Plant Protection.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All Products: As specified by Erosion and Sedimentation Control Handbook.

B. All Fill Materials: In accordance with requirements of Section 312000, "Earth Moving for Structures and Pavements".

C. Temporary Vegetative Stabilization: Temporary Seeding for graded or cleared areas, which are subject to erosion for a period of 14 days or more. Vegetation in accordance with Handbook.

D. Permanent Vegetative Stabilization: Seeding for graded or cleared areas subject to erosion where a permanent, long-lived vegetation cover is needed. Vegetation in accordance with Handbook.

E. Riprap Waterways and Outfalls:

1. Riprap: Sizes indicated.
2. Drainage Fabric:

a. Outfalls: needle-punched nonwoven geotextile composed of polypropylene fibers, possessing the following characteristics:

Mechanical Properties	Test method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D 4632	N (lbs)	912 (205)	912 (205)
Grab Tensile Elongation	ASTM D 4632	%	50	50
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	356 (80)	356 (80)
CBR Puncture Strength	ASTM D 6241	N (lbs)	2225 (500)	
Apparent Opening Size (AOS) *	ASTM D 4751	mm (U.S. Sieve)	0.18 (80)	
Permittivity	ASTM D 4491	sec^{-1}	1.1	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	3870 (95)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70	

* ASTM D 4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D 5261	g/m^2 (oz/yd^2)	271 (8.0)	
Thickness	ASTM D 5199	mm (mils)	1.8 (72)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	4.5 x 91 (15 x 300)
Roll Area	--	m^2 (yd^2)	418 (500)	
Estimated Roll Weight	--	kg (lb)	120 (265)	

b. Acceptable products: Mirafi 180N or approved equal.

c. Waterways: needle-punched nonwoven geotextile composed of polypropylene fibers, possessing the following characteristics:

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD

Grab Tensile Strength	ASTM D 4632	N (lbs)	534 (120)	534 (120)
Grab Tensile Elongation	ASTM D 4632	%	50	50
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	223 (50)	223 (50)
CBR Puncture Strength	ASTM D 6241	N (lbs)	1335 (300)	
Apparent Opening Size (AOS) *	ASTM D 4751	mm (U.S. Sieve)	0.212 (70)	
Permittivity	ASTM D 4491	sec^{-1}	1.7	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	5500 (135)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70	

* ASTM D 4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D 5261	g/m^2 (oz/yd^2)	163 (4.8)	
Thickness	ASTM D 5199	mm (mils)	1.0 (40)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	4.5 x 110 (15 x 360)
Roll Area	--	m^2 (yd^2)	418 (500)	502 (600)
Estimated Roll Weight	--	kg (lb)	74 (164)	89 (197)

d. Acceptable products: Mirafi 140N or approved equal.

F. Grass Waterways & Embankments:

1. Vegetation: In accordance with Handbook; Section 329200, “Turf and Grasses”.

2. Erosion Control Mat: for slopes less steep than 2:1, short-term double net erosion control blanket, machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months.

Property	Test Method	Typical
Thickness	ASTM D6525	0.36 in (9.14 mm)
Resiliency	ECTC Guidelines	80.5%
Water Absorbency	ASTM D1117	514%
Mass/Unit Area	ASTM 6475	10.52 oz/yd^2 (357.7 g/m^2)
Swell	ECTC Guidelines	15%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	6.06 oz-in
Light Penetration	ECTC Guidelines	9.8%
Tensile Strength –MD	ASTM D6818	169.2 lbs/ft (2.51 kN/m)
Elongation – MD	ASTM D6818	17.2%
Tensile Strength – TD	ASTM D6818	164.4 lbs/ft (2.44 kN/m)
Elongation – TD	ASTM D6818	33.1%

3. Acceptable products: North American Green S150 or approved equal.
4. Erosion Control Mat: for slopes 2:1 or steeper, extended-term double net erosion control blanket, machine-produced mat of 70% agricultural straw and 30% coconut fiber with a functional longevity of up to 24 months.

Property	Test Method	Typical

Thickness	ASTM D6525	0.39 in (9.91 mm)
Resiliency	ECTC Guidelines	75%
Water Absorbency	ASTM D1117	285%
Mass/Unit Area	ASTM 6475	11.44 oz/yd^2 (388 g/m^2)
Swell	ECTC Guidelines	30%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	1.11 oz-in
Light Penetration	ECTC Guidelines	8.7%
Tensile Strength –MD	ASTM D6818	146.6 lbs/ft (2.17 kN/m)
Elongation – MD	ASTM D6818	26.9%
Tensile Strength – TD	ASTM D6818	147.6 lbs/fit (2.19 kN/m)
Elongation – TD	ASTM D6818	25.2%

5. Acceptable products: North American Green SC150 or approved equal.
6. Turf Reinforcement Mat: permanent composite turf reinforcement mat, machine-produced mat of 70% straw and 30% coconut fiber matrix incorporated into permanent three-dimensional turf reinforcement matting.

Property	Test Method	Typical	Net only
Thickness	ASTM D6525	0.72 in (18.3 mm)	0.48 in
Resiliency	ASTM 6524	95.2%	--
Density	ASTM D792	0.53 oz/in^3	--
Mass/Unit Area	ASTM 6566	17.88 oz/yd^2 (606 g/m^2)	--
Porosity	ECTC Guidelines	99%	--
Stiffness	ASTM D1388	222.65 oz-in	--
Light Penetration	ECTC Guidelines	8.9%	--
UV Stability	ASTM D4355 / 1000 hr	100%	100%
Tensile Strength –MD	ASTM D6818	620 lbs/ft (9.05 kN/m)	655 lbs/ft
Elongation – MD	ASTM D6818	35%	25%
Tensile Strength – TD	ASTM D6818	737 lbs/ft (10.75 kN/m)	666 lbs/ft
Elongation – TD	ASTM D6818	16%	16%

7. Acceptable products: North American Green SC250 or approved equal.
8. Pins: U or T type as recommended by fabric manufacturer.

G. Temporary Construction Entrances:

1. Coarse Aggregate in accordance with requirements of Section 312000, “Earth Moving for Structures and Pavements”.
2. Culvert: RCP.
3. Fabric: woven polypropylene separation geotextile, possessing the following characteristics:

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D 4632	N (lbs)	1402 (315)	1402 (315)
Grab Tensile Elongation	ASTM D 4632	%	12	
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	503 (113)	503 (113)
CBR Puncture Strength	ASTM D 6241	N (lbs)	4005 (900)	
Apparent Opening Size (AOS) *	ASTM D 4751	mm (U.S. Sieve)	0.43 (40)	

Permittivity	ASTM D 4491	sec^{-1}	0.05
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	163 (4.0)
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70

* ASTM D 4751, AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D 5261	g/m^2 (oz/yd^2)	203 (6.0)	
Thickness	ASTM D 5199	mm (mils)	0.6 (25)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	5.3 x 78.7 (17.5 x 258)
Roll Area	--	m^2 (yd^2)	418 (500)	418 (500)
Estimated Roll Weight	--	kg (lb)	109 (240)	109 (240)

4. Acceptable products: Mirafi 600X or approved equal.

H. Hay Bale Barriers, Dams:

1. Barriers: Wire or nylon bound straw or hay bales.
2. Stakes: Steel rebar or 2 x 2 inch wood stakes.

I. Silt Fence:

1. Posts:

   a. Wood: Minimum 2 inch hardwood stakes.
   b. Steel: Type T or Type U.

2. Fabric: High strength polypropylene netting treated to ensure protection against sunlight degradation:

Mechanical Properties	Test Method	Unit	Silt Fence Property		Typical Values (English)
			MD	CD	
Grab Tensile Strength	ASTM D 4632	kN	0.55	0.55	125 X125 lbs
Grab Tensile Elongation	ASTM D 4632	%	15	15	15 %
Puncture Strength	ASTM D 4833	kN	266		60 lbs.
Apparent Opening Size (AOS) *	ASTM D 4751	mm	0.60		20 sieve
Permittivity	ASTM D 4491	sec^{-1}	0.10		0.10 sec^{-1}
Flow Rate	ASTM D 4491	$l/min/m^2$	405		8 gal/min/ft2
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70		70 %

* ASTM D 4751, AOS is a Maximum Opening Diameter Value

3. Mirafi Silt Fence.
   a. Propex Geotex woven Silt Fence
   b. Carthage Mills FX-11 Silt Fence
   c. Approved equal.

J. Riprap Embankments:

1. Riprap: Sizes indicated.
2. Drainage Fabric: Mirafi 180N or approved equal.

K. Stone Check Dams:

1. Stone: Sizes indicated.
2. Fabric: woven polypropylene separation geotextile, possessing the following characteristics:

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D 4632	N (lbs)	890 (200)	890 (200)
Grab Tensile Elongation	ASTM D 4632	%	15	10
Trapezoid Tear Strength	ASTM D 4533	N (lbs)	334 (75)	334 (75)
CBR Puncture Strength	ASTM D 6241	N (lbs)	3115 (700)	
Apparent Opening Size (AOS) *	ASTM D 4751	mm (U.S. Sieve)	0.43 (40)	
Permittivity	ASTM D 4491	sec^{-1}	0.05	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	204 (5.0)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70	

* ASTM D 4751, AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D 5261	g/m^2 (oz/yd^2)	136 (4.0)	
Thickness	ASTM D 5199	mm (mils)	0.5 (20)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 132 (12.5 x 432)	5.3 x 94.2 (17.5 x 309)
Roll Area	--	m^2 (yd^2)	502 (600)	502 (600)
Estimated Roll Weight	--	kg (lb)	95 (210)	95 (210)

3. Acceptable products: Mirafi 500X or approved equal.

PART 3 - EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

A. Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

B. Land Resources:

1. Protection of Vegetation: Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Architect/Engineer permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Architect/Engineer. Where such use of attach ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage. Protect existing trees, which are to remain, and which may be injured, bruised, defaced, or otherwise damaged by construction operations.

Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed.

C. Grading

1. Limit initial grading to that required to install required sediment and erosion controls.
2. Extent: Remain just ahead of planned new construction.
3. Plan to control runoff and contain erosion.
4. Do not place fill before existing vegetation has been removed.
5. Do not impair existing surface drainage, create potential hazards, cause hazardous erosion, or cause sediment to collect in drainage systems on adjacent properties, alleys, streets or highways by grading operations.
6. Riprap Outfalls, Outlets, and Waterways: Construct in accordance with details. Embed riprap in approved fabric.
7. Grass Waterways: Construct in accordance with details for specific profile. Pin fabric mesh to subgrade with U or T pins in accordance with fabric manufacturer's recommendations.
8. Hay Bales:

    a. Place at areas indicated in rows with ends tightly butted.
    b. Embed each bale a minimum of 4 inches into soil.
    c. Securely anchor in place with two stakes driven 1-1/2 to 2 feet into ground.

9. Silt Fence:

    a. Establish silt fence at areas indicated and as required for control.
    b. Space posts as required to adequately support wire and cloth against flow and at a maximum of 6 feet oc. Embed posts into ground a minimum of 18 inches.
    c. Fasten woven wire fence securely to posts with wire ties or staples.
    d. Fasten filter cloth to wire mesh at top and mid-section with ties spaced every 24 inches; overlap edges minimum 6 inches and fold.
    e. Embed filter cloth minimum 8 inches into ground.

D. Borrow Pit Areas: Manage and control borrow pit areas to prevent sediment from entering nearby streams or lakes. Restore areas, including those outside the borrow pit, disturbed by borrow and haul operations. Restoration includes grading, replacement of topsoil, and establishment of a permanent vegetative cover. Uniformly grade side slopes of borrow pit to not more than a slope of 1 part vertical to 2 parts horizontal. Uniformly grade the bottom of the borrow pits to provide a flat bottom and drain by outfall ditches or other suitable means. Stockpile topsoil removed during the borrow pit operation, and use as part of restoring the borrow pit area.

E. Protection of Erodible Soils: Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

F. Mechanical Retardation and Control to Runoff: Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

G. Vegetation and Mulch: Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

1. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to reestablish a suitable stand of grass. The seeding operation shall be as specified in Section 329200, “Turf and Grasses”.

H. Stabilization

1. Stabilize all cleared or graded areas. Stabilize with temporary or permanent vegetation, mulch, or paving as indicated on Drawings within 15 days of obtaining final grade or 30 days after obtaining temporary grade.
2. For vegetating critical areas where erosion is imminent, place and repeatedly replace adequate mulch, fertilizer, and seed until a vigorous and adequate growth of turf has been established over greater than 80 percent of the area.

I. Replacement: Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Architect/Engineer's approval before replacement.

J. Temporary Construction: Remove traces of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction. Grade temporary roads, parking areas, and similar temporarily used areas to conform with surrounding contours.

K. Burnoff: Burnoff of the ground cover is not permitted.

L. Dust Control: Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shaking bags of cement, concrete mortar, or plaster.

3.2 MAINTENANCE

A. Vegetative Stabilization: Irrigate to prevent loss of stand of protective vegetation. Regularly inspect and overseed as necessary. Immediately reestablish damaged stands.

B. Hay Bales: Inspect weekly and after every rain; adjust as needed, removing material when bulges develop.

C. Silt Fence: Inspect weekly and after every rain; adjust as needed, removing material when bulges develop.

D. Construction Entrances: Inspect and repair after every rain. Maintain in a condition to prevent tracking or flowing of sediment onto public right-of-ways. Dress with stone as required.

E. Swales, Outfalls: Inspect regularly and after every rain; maintain clear of obstructions and excessive sediment.

F. Dikes, Embankments, Landgrading: Inspect weekly and after every rain. Repair as required to maintain integrity or drainage areas.

3.3 REPAIRS, REMOVALS

A. At completion of work, remove designated temporary controls and revise all permanent sediment controls to original condition.

B. Repair all damages caused by soil erosion and construction activity at or before the end of every working day.

C. Remove sediment fence when all disturbed areas have been stabilized and a catch of grass greater than 80 percent has been established.

END OF SECTION 313000

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Sections:

1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
3. Division 31 Section "Dewatering" for dewatering system for excavations.
4. Division 31 Section “Earth Moving for Structures and Pavements”
5. Division 31 Section “Earth Moving for Utilities”

1.3 PERFORMANCE REQUIREMENTS

A. Furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Prevent surface water from entering excavations by grading, dikes, or other means.
2. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
3. Monitor vibrations, settlements, and movements.

1.4 PROJECT CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is included elsewhere in the Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

D. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlaying construction and abandon remainder.
2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes work pertaining to new and recycled bituminous concrete pavings, including sidewalks, gutters, and HMA curbing.

B. Related Sections:

1. Division 31 Section "Site Clearing" for demolition, removal, and recycling of existing asphalt pavements.
2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Division 32 Sections for other paving installed.
4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.
5. A Geotechnical Report has been provided elsewhere in the project manual, please review for additional information and limitations.

1.3 PREINSTALLATION CONFERENCE: Conduct conference at Project site.

A. Review methods and procedures related to providing and placement of asphalt pavement including, but not limited to, the following

1. Construction Schedule
2. Field quality control
3. Traffic control

1.4 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO M156	1989 (Rev. 1993) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

AASHTO T84	1995 Standard Specification for Specific Gravity and Absorption of Fine Aggregate
AASHTO T176	1997 (Rev. 1999) Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test
AASHTO T304	1996 Standard Method of Test for Uncompacted Void Content of Fine Aggregate
AASHTO TP-4	1999 Standard Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the SHRP Gyratory Compactor
AASHTO TP-58	1999 Standard Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI A10.17	2006 Safe Operating Practice for Asphalt Pavement Construction

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C128	2007 (Rev. A) Specific Gravity and Absorption of Fine Aggregate
ASTM C142	1997 (Rev. 2004) Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C295	2008 Petrographic Examination of Aggregate for Concrete
ASTM D979	2006 (Rev. 1) Sampling Bituminous Paving Mixtures
ASTM D2172	2005 Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D4791	2005 Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	2001 (Rev. 2006) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate

STATE OF MAINE DEPARTMENT OF TRANSPORTATION (MDOT) STANDARD SPECIFICATIONS, 12/2002

MDOT 401	Hot Mix Asphalt Pavement

1.5 GENERAL REQUIREMENTS (MDOT 401.01)

A. The Contractor shall furnish and place one or more courses of Hot Mix Asphalt Pavement (HMA) on an approved base in accordance with the contract documents and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans.

1.6 SUBMITTALS

A. Mix Designs (Contractor and Job) (produced within the current paving season)

1. The Contractor shall submit for approval a Job Mix Formula (JMF) to the Owner's independent testing agency for each mixture to be supplied. The Owner's independent testing agency shall then have 15 calendar days in which to process a new design prior to approval. The JMF shall establish a single percentage of aggregate passing each required sieve size within the limits shown in Table 2, and shall not cross the restricted zone. The general composition limits given in Table 2 indicate the control points of mixtures permissible under this specification. The JMF shall state the source, gradation, and percentage to be used of each portion of the aggregate, and mineral filler if required. It shall also state the proposed Performance Graded Asphalt Binder (PGAB) content, the name and location of the refiner and the supplier for the source of PGAB submitted for approval, and the type of PGAB modification if applicable.
2. At the time of JMF submittal, the Contractor shall identify and make available the stockpiles of all proposed aggregates at the plant site. The Owner's independent testing agency shall obtain samples for laboratory testing. The Contractor shall also make available to the Owner's independent testing agency the PGAB proposed for use in the mix in sufficient quantity to test the properties of the asphalt and to produce samples for testing of the mixture. The Contractor shall submit a new JMF for approval each time a change in aggregate source or a change in PGAB is proposed. The same approval process shall be followed. The cold feed percentage of any aggregate may be changed up to 10 percent of the amount listed on the JMF, however no aggregate listed on the JMF shall be eliminated. The target percentage of RAP shall be the percentage listed on the JMF.

B. Certificates of Compliance

1. Submit a certificate of compliance for each shipment of hot mix asphalt material used in the mix.
2. Submit a certificate of compliance for hot mix asphalt curbing material.

C. Drawings

1. Provide details of all proposed curbing sections including length, radius, height, and width.

1.7 DELIVERY AND STORAGE

A. Inspect materials delivered to the site for damage and store with a minimum of handling. Store aggregates in such a manner as to prevent segregation, contamination, or intermixing of the different aggregate sizes.

1.8 TRAFFIC CONTROL

A. Vehicular traffic, including heavy equipment, shall not be permitted on the pavement until the surface temperature has cooled to at least 120-degrees F. Surface temperature shall be measured by approved surface thermometers or other satisfactory methods.

1.9 OPERATION SAFETY AND HEALTH GUIDELINES

A. In addition to the requirements of the General Provisions, conduct mixing and delivery of hot mix asphalt materials and paving operations in accordance with ANSI A10.17.

1.10 WEATHER AND SEASONAL LIMITATIONS

A. The Contractor may place Hot Mix Asphalt Pavement for use other than a traveled way wearing course provided that the air temperature as determined by an approved thermometer (placed in the shade at the paving location) is 4•C (40•F) or higher and the area to be paved is not frozen. The Contractor may place Hot Mix Asphalt Pavement as traveled way wearing course provided the air temperature determined as above is 10•C (50•F) or higher.

B. The State is divided into two paving zones as follows:

1. Zone 1 Areas north of US Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.
2. Zone 2 Areas south of Zone 1 including the US Route 2 and Route 9 boundaries.

C. The Contractor may place Hot Mix Asphalt Pavement for use other than a traveled way wearing course in either Zone between the dates of April 15th and November 15th, provided that the air temperature as determined by an approved thermometer (placed in the shade at the paving location) is 4°C (40°F) or higher and the area to be paved is not frozen. The Contractor may place Hot Mix Asphalt Pavement as traveled way wearing course in Zone 1 between the dates of May 1st and the Saturday following October 1st and in Zone 2 between the dates of April 15th and the Saturday following October 15th, provided the air temperature determined as above is 10°C (50°F) or higher. For the purposes of this Section, the traveled way includes truck lanes, ramps, approach roads and auxiliary lanes. Hot Mix Asphalt Pavement used for curb, driveways, sidewalks, islands, or other incidentals is not subject to seasonal limitations, except that conditions shall be satisfactory for proper handling and finishing of the mixture. Unless otherwise specified, the Contractor shall not place Hot Mix Asphalt Pavement on a wet or frozen surface, and the air temperature shall be 4°C (40°F) or higher.

1.11 EXISTING CONDITIONS

A. Existing To New Pavements: Where new pavement matches to old care shall be taken to insure proper binding of the two materials. Utilize an asphalt binding paint as required. Both existing and new surfaces shall meet in a smooth continuous plane free from variations in height or smoothness. Clean all areas to meet thoroughly prior to installation.

B. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.

1. The geotechnical report is included elsewhere in the Project Manual.
2. Please refer to the geotechnical report for possible additional information and guidelines related to the pavement design.

1.12 DEFINITIONS

A. Deleterious material is defined as those particles of aggregate which may be crumbled in the hand and those which have an absorption greater than 3.0-percent by weight determined in accordance with AASHTO T85 modified for weight of sample. The types which are determined to be deleterious are generally highly absorptive shales, phylites, sandstones and rotten rock of various kinds.

B. Fine Aggregate

1. Fine aggregate, from an individual source or stockpile used for blending when tested for absorption as specified in AASHTO T84 (ASTM C128), shall show a percent of absorption of not more than 2.30.
2. Deleterious substances shall not exceed the following limits:

Maximum permissible limits, percent by weight	
Friable particles, clay lumps, AASHTO T112 (ASTM C142)	1.5
Other deleterious substances such as shale, alkali, mica, coated grains, soft and flaky particles, ASTM C295	1.0

C. Loose and Broken Pavement: Existing asphalt, bituminous or concrete pavement that is visibly unattached or separated from surrounding pavement. This includes pavement that can be physically removed by hand or depressed when stood upon. Pavement that is "Alligatored" or cracked through to the underlying layer is considered broken. Pavement with seams or longitudinal cracks spaced wider than 3 feet apart is not considered Loose or Broken.

1.13 HOT MIX ASPHALT PLANT (MDOT 401.07)

A. General Requirements (MDOT 401.071): Mixing plants shall conform to AASHTO M 156. The mixing plant shall include an efficient dust collecting system to prevent loss of fine material. The material collected may be returned to the mixture at a uniform rate and/or be discarded.

1. Performance Graded Asphalt Binder. The Contractor shall provide a valve for sampling the bituminous material, located in a circulating feed line connecting the storage tank with the mixing plant or in a line of the storage circulation system. The valve shall be in a readily accessible location offering protection from damage. The Contractor shall maintain this valve in a workable condition and provide a drainage receptacle.

B. Automation of Batching (MDOT 401.072): Batch plants shall be automated for weighing, recycling, and monitoring the system.

1. The batch plant shall accurately proportion the various materials in the proper order by weight. The entire batching and mixing cycle shall be continuous and shall not require any manual operations. The batch plant shall use auxiliary interlock circuits to trigger an audible alarm whenever an error exceeding the acceptable tolerance occurs. Along with the alarm, the printer shall print an asterisk on the delivery slip in the same row containing the out-of-tolerance weight. The automatic proportioning system shall be capable of consistently delivering material within the full range of batch sizes. When RAP is being used the plant must be capable of automatically compensating for the moisture content of the RAP.
2. Tolerances are based on the total batch weight of the Hot Mix Asphalt Pavement. The batch plant shall be able to automatically or manually adjust for all desired batch sizes. The first or last bin drawn shall be the sand bin. Allowable tolerances are as follows:

Each aggregate component	± 1.5 percent from the cumulative target, each bin
Last Bin Drawn	± 1.5 percent
Mineral Filler	± 0.5 percent
Performance Graded Asphalt	+0.25 percent, -0.15 percent

Binder	
Zero Return (aggregate)	± 0.5 percent
Zero Return (bituminous material)	0.1 percent

1.14 HAULING EQUIPMENT (MDOT 401.08)

A. Trucks for hauling Hot Mix Asphalt Pavement shall have tight, clean, smooth metal dump bodies which have been thinly coated with a small amount of lime solution or an approved soap solution or detergent to prevent the mixture from adhering to the bodies.

B. All truck dump bodies shall have a cover of canvas or other water repellent material capable of heat retention which completely covers the mixture. The cover shall be securely fastened on the loaded truck except when unloading.

C. All truck bodies shall have an opening on both sides which will accommodate a thermometer stem. The opening shall be located near the midpoint of the body, at least 300 mm (12 inches) above the bed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All references for materials contained within this specification are drawn from the State of Maine Department of Transportation (MDOT) 12/2002, Maine State Standard Specifications latest edition.

B. Hot Mix Asphalt Pavement Mix: The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. HMA shall be designed and tested according to AASHTO TP-4. The Contractor shall size, uniformly grade, and combine the aggregate fractions in proportions that provide a mixture meeting the grading requirements of the Job Mix Formula (JMF). The Contractor may use a maximum of 20 percent reclaimed asphalt pavement (RAP) in any base, binder or shim course, and in any wearing course placed on shoulders (excluding Urban areas). Up to 10 percent RAP will be allowed on mainline surface courses provided that the same JMF is utilized for the full width including shoulders.

C. Granular Fill: Shall be as specified in Division 31, Section Earth Moving.

1. Granular Base: Shall be as specified in Division 31, Section Earth Moving.
2. Composition of mixtures - (MDOT 401.02 - Supplemental Specification): The coarse and fine aggregate shall meet the requirements of paragraph “Aggregate Schedule.” The several aggregate fractions for mixtures shall be sized, graded and combined in such proportions that the resulting composite blends will meet the grading requirements of the following table unless otherwise shown on the drawings.

TABLE 1
COMPOSITION OF MIXTURES - CONTROL POINTS

SIEVE SIZE	GRADING			
	TYPE 19 mm (3/4 inch)	TYPE 12.5 mm (1/2 inch)	TYPE 9.5 mm (½ inch)	TYPE: 4.75 mm (No. 4)
	PERCENT BY WEIGHT PASSING - COMBINED AGGREGATE			
37.5 mm (1 ½ inch)				

25 mm (1 inch)	100			
19 mm (3/4 inch)	90-100	100		
12.5 mm (½ inch)	-90	90-100	100	100
9.5 mm (3/8 inch)	-	-90	90-100	95-100
4.75 mm (No. 4)	-	-	-90	80-100
2.36 mm (No. 8)	23-49	28-58	32-67	40-80
1.18 mm (No. 16)	-	-	-	-
0.60 mm (No. 30)	-	-	-	-
0.30 mm (No. 50)	-	-	-	-
0.075 mm (No. 200)	2-8	2-10	2-10	2-10

-- End of Table 1. --

TABLE 2: VOLUMETRIC DESIGN CRITERIA

Design ESAL's (Millions)	Required Density (Percent of G_{mm})			Voids in the Mineral Aggregate (VMA)(Minimum Percent)					Voids Filled with Binder (VFB) (Minimum %)	Fines/Eff. Binder Ratio
				Nominal Maximum Aggregate Size (mm)						
	$N_{initial}$	N_{design}	N_{max}	25 (1 inch)	19 (3/4 inch)	12.5 (½ inch)	9.5 (3/8 inch)	4.75 (#4)		
<0.3	≤91.5	96.0	≤98.0	12.0	13.0	14.0	15.0	16.0	70-80	0.6-1.4
0.3 to <3	≤90.5								65-78	
3.0 to <10	≤89.0								65-75*	
10 to <30										
≥30										

*For 9.5 mm (3/8 inch) nominal maximum aggregate size mixtures, the maximum VFB is 76. For 4.75 (#4) nominal maximum aggregate size mixtures, the maximum VFB is 80.

-- End of Table 2. –

3. Aggregate Schedule: Shall meet the total percentage by weight of aggregate passing the sieve designation as defined in Table 1 of Par. 2.1.C.2 and unless indicated otherwise on contract drawings or in the specifications.

   a. Base Course: (Roadway) 19.0 mm (as noted on drawings), (walkways) 12.5 mm.
   b. Finish Course (Roadways and Walkways): 9.5 mm.
   c. Fine aggregate, that material passing the 2.36 mm sieve, shall not exceed an absorption of 3.0 percent by weight as determined by AASHTO T84. The composite blend shall have a Micro-Deval value of under 18.0 or less as determined by AASHTO TP 58-99. In the event of a failure, the Washington State Degradation test of 1967 shall be run prior to rejection of the material. Material with a value of 30 or more may be accepted. Aggregates shall also meet the following Table 3 consensus properties. The Owner reserves the right to sample and test the composite aggregate for any of the following properties at any time.

TABLE 3: AGGREGATE CONSENSUS PROPERTIES CRITERIA

Estimated Traffic, Million 80 kN	ASTM D 5821 Coarse Aggregate	AASHTO T-304 Method A Uncompacted	ASTM D 4791(8.4) Flat and	AASHTO T176 Clay Content/Sand

(18 kips) ESALs	Angularity (Minimum)	Void Content of Fine Aggregate (Minimum)	Elongated Particles (Maximum)	Equivalent (Minimum)
<0.3	60/60	40	10	45
0.3 to <3.0	75/60			
3.0 to <10	85/80	45		
10 to <30	95/90			
≥30	100/100			50

ASTM D 5821 - "85/80" denotes that 85% of the coarse aggregate has one fractured face and 80% has two fractured faces.
AASHTO TP304 - Criteria are presented as percent air voids in loosely compacted fine aggregate, (U).
ASTM 4791 - Criteria are presented as maximum percent by weight of flat and elongated particles. (5:1 ratio).

-- End of Table 3. --

4. Temperature Requirements (MDOT 401.04): After the JMF is established, the temperatures of the mixture shall conform to the following tolerances:
   In the truck at the mixing plant ± 10•C (20•F)
   At the Paver ± 10•C (20•F)
   The JMF and the mix subsequently produced shall meet the requirements of Tables 2 and 3.

5. Gyrations: Mix design shall be 50 gyrations. Substitutions allowed by prior approval of the Architect only.

2.2 CONSTRUCTION EQUIPMENT

A. Mixing: Provide hot mix asphalt mixture in a mixing plant as specified herein.

B. Pavers (MDOT 401.09): Dependable and adequate for the purpose intended, properly maintained in satisfactory and safe operating condition at all times. Pavers shall be self-contained, self-propelled units with an activated screed (heated if necessary) capable of placing courses of Hot Mix Asphalt Pavement in full lane widths, shoulder or similar construction.

C. Rollers (MDOT 401.10): Rollers shall be static steel, pneumatic tire, or approved vibrator type. Rollers shall be in good mechanical condition, capable of starting and stopping smoothly, and be free from backlash when reversing direction. Rollers shall be equipped and operated in such a way as to prevent the picking up of hot mixed material by the roller surface. Use of rollers which result in crushing of the aggregate or displacement of the mixture will not be permitted. Any Hot Mix Asphalt Pavement that becomes loose, broken, contaminated, shows an excess or deficiency of Performance Graded Asphalt Binder, or is in any other way defective shall be removed and replaced at no additional cost with fresh Hot Mix Asphalt Pavement which shall be immediately compacted to conform with the adjacent area. The type of rollers to be used and their relative position in the compaction sequence shall generally be the Contractor's option, provided specification densities are attained and with the following requirements:

1. At least one roller shall be pneumatic-tired on bridges and variable depth courses as well as the first lift of pavement over gravel or a reclaimed pavement or other irregular surface.
2. Compaction with a vibratory or steel wheel roller shall precede pneumatic-tired rolling.
3. Vibratory rollers shall not be operated in the vibratory mode when checking or cracking of the mat occurs, or on bridge decks.

4. Any method which results in cracking or checking of the mat will be discontinued and corrective action taken.
5. The maximum operating speed for a steel wheel roller shall not exceed the manufacturer's recommendations.

2.3 CURBING

A. Hot mix asphalt Curbing: MDOT Type 3 Bituminous Curbing, 712.36. The asphalt cement for bituminous curb shall be of the grade required for the wearing course. The aggregate shall conform to the requirements of Table 3. The coarse aggregate portion retained on the No. 8 sieve may be either crushed rock or crushed gravel. The mineral constituents of the bituminous mixture shall be sized and graded and combined in a composite blend that will produce a stable durable curbing with an acceptable texture.

B. Concrete curbing: as specified in Section 321313 Site Concrete.

C. Granite Curbing: as specified in Section 321313 Site Concrete.

PART 3 - EXECUTION

3.1 CONSTRUCTION PROCEDURES

A. Granular Base and Subbase: The granular base and subbase materials shall be installed in lifts not exceeding 18" and compacted to 95% modified proctor. The granular material shall be brought to the depths and grades as shown on the drawings and specified herein. Care shall be taken to insure no damage to the finish grade prior to the application of the hot mix asphalt concrete paving.

B. Plant Mix Pavements: Composition of Mixtures: The hot mix asphalt plant admixture shall be composed of aggregate, filler if required and hot mix asphalt material. The several aggregate fractions shall be sized, uniformly graded and combined in proportions that will provide a mixture meeting the grading requirements of the job-mix formula.

C. Transportation of Hot mix asphalt Mixtures (MDOT 401.08): Trucks for hauling Hot Mix Asphalt Pavement shall have tight, clean, smooth metal dump bodies which have been thinly coated with a small amount of lime solution or an approved soap solution or detergent to prevent the mixture from adhering to the bodies. Petroleum products will not be permitted for coating truck bodies. All truck dump bodies shall have a cover of canvas or other water repellent material capable of heat retention which completely covers the mixture. The cover shall be securely fastened on the loaded truck except when unloading. All truck bodies shall have an opening on both sides which will accommodate a thermometer stem. The opening shall be located near the midpoint of the body, at least 300 mm (12 inches) above the bed.

D. Make deliveries so that the spreading and rolling of all the mixture prepared for one day's run can be completed during daylight, unless adequate approved artificial lighting is provided. Deliver mixture to the area to be paved in such a manner that the temperature at the time of dumping into the spreader will be higher than that specified herein. Reject any loads that are below minimum temperature, that have crusts of cold unworkable material, or that have been wet excessively by rain. Hauling over freshly laid material is not permitted.

E. Placing:

1. Surface Preparation of Underlying Course (MDOT 401.11): Prior to the laying of the asphalt (hot mix asphalt) concrete, the Contractor shall thoroughly clean the surface upon which Hot Mix Asphalt Pavement is to be placed of all objectionable material, including loose or broken pavement. Remove or clean matter by power brush or milling machine and finish with power blower or brush. When the surface of the existing base or pavement is irregular, the Contractor shall bring it to uniform grade and cross section. Milled paving shall be finished flat with a straight and square edge, free from irregularities or bulges. Hand brooms or other cleaning methods may be used if approved by Architect/Engineer. Dispose of matter in accordance with applicable Local, State and Federal codes.
2. Spraying of Contact Surfaces (Tack Coat): Spray contact surfaces of previously constructed pavement (longer than 7 days) with a thin coat of emulsified asphalt material conforming to MDOT specifications for emulsified asphalt tack coat. Paint contact surfaces of structures with a thin coat of emulsified asphalt or other approved material prior to placing the mixture.
3. General Requirements for Use of Hot mix asphalt Spreaders: The Contractor shall place Hot Mix Asphalt Pavement with a paver using an automatic grade and slope controlled screed. The controls shall automatically adjust the screed and increase or decrease the layer thickness to compensate for irregularities in the preceding course. The controls shall maintain the proper transverse slope and be readily adjustable so that transitions and superelevated curves can be properly paved. The controls shall operate from a fixed or moving reference such as a grade wire or ski type device (floating beam) with a minimum length of 9 m (30 foot).
4. The Contractor shall operate the paver in such a manner as to produce a visually uniform surface texture and a thickness within the requirements of Subsection 401.101 Surface Tolerances. The paver shall have a receiving hopper with sufficient capacity for a uniform spreading operation and a distribution system to place the mixture uniformly, without segregation in front of the screed. The screed assembly shall produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screeds shall have auger extensions and tunnel extenders as necessary.
5. The range of temperatures of the mixtures at the time of spreading shall be between 250-degrees F and 300-degrees F. Hot mix asphalt concrete having temperatures less than minimum spreading temperature when dumped into the spreader will be rejected.
6. On roads opened to two way traffic, the Contractor shall place each course over the full width of the traveled way section being paved that day.
7. Hand-spreading in Lieu of Machine-spreading (MDOT 401.15): On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the Contractor shall spread, rake, and lute the mixture with hand tools to provide the required compacted thickness. The range of temperatures of the mixtures when dumped onto the area to be paved shall be between 250-degrees F and 300-degrees F. Hot mix asphalt concrete having temperatures less than minimum spreading temperature when dumped onto the area to be paved will be rejected.

F. Compaction of Mixture (MDOT 401.16): Immediately after the Hot Mix Asphalt Pavement has been spread, struck off, and any surface irregularities adjusted, the Contractor shall thoroughly and uniformly compact the mixture by rolling. The Contractor shall roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving. The Contractor shall prevent adhesion of the mixture to the rollers or vibrating compactors without the use of oil.

G. The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued. Any new pavement that shows obvious cracking, checking, or displacement may be removed and replaced for the full lane width as directed by the Architect/ Engineer at no cost to the Owner.

H. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the Contractor shall thoroughly compact the mixture with mechanical vibrating compactors. The Contractor shall only use hand tamping in areas inaccessible to all other compaction equipment. On depressed areas, the Contractor may use a trench roller or cleated compression strips under a roller to transmit compression to the depressed area.

I. Joints (MDOT 401.17): The Contractor shall construct wearing course transverse joints in such a manner that minimum tolerances shown in section 401.101 are met when measured with a straightedge. The paver shall always maintain a uniform head of material during the joint construction. The hot asphalt mix shall be free of segregation and meet temperature requirements. Transverse joints of the wearing course shall be straight and neatly trimmed. The Contractor may form a vertical face exposing the full depth of the course by inserting a header, by breaking the bond with the underlying course, or by cutting back with hand tools.

J. The Contractor shall apply a coating of emulsified asphalt immediately prior to paving all joints, except those formed by pavers operating in echelon. The Contractor shall use an approved spray apparatus designed for covering a narrow surface. The Architect/ Engineer may approve application by a brush for small surfaces, or in the event of a malfunction of the spray apparatus, but for a period of not more than one working day.

K. Where pavement under this Contract joins an existing pavement, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Architect/ Engineer will not permit broken or raveled edges.

L. All joints shall present the same texture, density, and smoothness as other portions of the course. Carefully make joints between old and new pavement or within new pavements in a manner as to ensure a thorough and continuous bond between old and new sections of the course. Paint all vertical contact surfaces of previously constructed sections with a thin uniform coat of emulsion or other approved material just before the fresh mixture is placed.

M. Curbing (MDOT 609.04)

1. Before placing the curb, the foundation course shall be thoroughly cleaned of all foreign and objectionable material. String or chalk lines shall be positioned on the prepared base to provide guide lines. The foundation shall be uniformly painted with tack coat at a rate of 0.2 to 0.7 L/m^2 (0.04 to 0.14 gal/yd^2).
2. The curb shall be placed by an approved power operated extruding type machine using the shape mold called for. A tight bond shall be obtained between the base and the curb. The resulting curbing shall conform in all respects to the curbing produced by the machine.
3. The curb will be sealed with bituminous sealing compound only when directed by the Engineer. Before sealing, the curb shall be clean, dry and shall have reached the ambient temperature.
4. When required, the curb shall be painted and coated with glass beads in accordance with Section 321219 “Pavement Markings”. Curb designated to be painted shall not be sealed with bituminous sealing compound.
5. Curb may be accepted or rejected based on appearance concerning texture, alignment, or both. All damaged curb shall be removed and replaced at the Contractor's expense.

3.2 FIELD SAMPLING AND TESTING

A. Sampling (MDOT 401.203): One sample will be taken from the paver hopper or the truck body per 250 Mg (275 ton) per pay item. The mix will be tested for gradation and PGAB content. If the mix is within

the USL and LSL tolerances listed in Table 4, the Owner will pay on the basis of the contract price outlined in the bid form and as reflected on the Contractor prepared schedule of values.

TABLE 4: GRADATION, VOLUMETRIC AND PGAB CONTENT VERIFICATION LIMITS

Property	USL and LSL	REJECTION LIMITS
	Method C	
Percent Passing 4.75 mm (No. 4) and larger sieves	Target ± 7	Target ± 9
Percent passing 2.36 mm (No. 8) to 1.18 mm (No. 16) sieves	Target ± 5	Target ± 7
Percent passing 0.60 (No. 30)	Target ± 4	Target ± 6
Percent passing 0.30 mm (No. 50) to 0.075 sieve (No. 200)	Target ± 3	Target ± 5
PGAB Content	Target ± 0.5	Target ± 0.7
Air Voids	Not applicable	Not applicable
Fines to Effective Binder	Not applicable	Not applicable
Voids in Mineral Aggregate	Not applicable	Not applicable
Voids Filled with Binder	Not applicable	Not applicable
In-place density	92.0 Minimum	-

-End of Table 4-

1. Pavement and Mixture: Owner's independent testing agency shall cut two 150 mm (6 inch) cores, which shall be tested for percent TMD, thickness and density of the completed pavements. Furnish all tools, labor and material for samples and for satisfactory replacement of pavement. Take samples and test at not less than frequency specified hereinafter and at the beginning of plant operations; for each day's work as a minimum; each change in the mix or equipment; and as often as directed. Accomplish sampling in accordance with ASTM D979. If the test results for each 250 Mg increment are outside the USL and LSL limits (see Table 4) the following deductions (Table 4b) shall apply. If the test results for each 275 Mg increment are outside the rejection limits presented in Table 4, the 275 ton sublot is subject to removal at the discretion of the Engineer. A second consecutive failing test shall result in cessation of production.

TABLE 4b

PGAB Content	-5%
2.36 mm sieve (No. 8)	-2%
0.30 mm sieve (No. 50)	-1%
0.075 mm sieve (No. 200)	-2%
Density	-10%*

*Only applies when called for.

-- End of Table 4b --

2. Sample Identification: Furnish each sample in a clean container, securely fastened to prevent loss of material. Tag each sample for identification. The tag shall contain the following information:
   Contract No._____
   Sample No._____Quantity_____
   Date of Sample_____
   Sample_____
   Source_____
   Intended use_____
   For testing_____

B. Testing:

1. General Contractor to arrange for and Owner to pay for all required field testing. The General Contractor shall pay for any required retesting by the Architect and Owner.
2. Pavement Courses Tests: Density: If required, determine the representative laboratory density by averaging the density of four laboratory specimens prepared in accordance with ASTM D1559.
3. Thickness: Match thickness as shown on drawing. Variations shall be removed and replaced to the proper thickness at no additional cost to the Owner.
4. Smoothness: Check surface tolerance with a 4.9 m (16 foot) straightedge or string line placed parallel to the centerline of pavement and with a 3 m (10 foot) straightedge or string line placed transverse to the centerline of pavement. Straightedge test the compacted surface of the leveling, binder and wearing courses as the work progresses. Apply straightedge parallel with and at right angles to the centerline after final rolling. Unevenness of the leveling and binder course shall not vary more than plus or minus ¼-inch in 10-feet; variations in the wearing course shall not vary more than plus or minus 1/8-inch in 10-feet. The Contractor shall correct any portion of the pavement showing irregularities greater than that specified by replacing it with new material.
5. Finished Grades: The finish grades of each course placed shall not vary from the finish elevations, profiles and cross sections indicated on the drawings by more than ½-inch.

END OF SECTION 321216

SECTION 321219 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes pavement markings with paint, thermoplastic compounds, or reflective media as indicated in the drawings and as specified herein. The work shall include but is not limited to the following:

1. 4” wide reflectorized white parking stall delineations.
2. 4” wide reflectorized yellow access road travel lane delineations.
3. 24” wide reflectorized white “stop” lines, locations as indicated on the drawings.
4. 8” wide reflectorized white crosswalk striping

B. Related sections:

1. Section 013300, Submittal Procedures.
2. Division 32 Section, “Asphalt Paving”

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M247 1996 Standard Specification for Glass Beads Used in Traffic Paint

FEDERAL SPECIFICATIONS (FS)

FS TT-B-1325 2007 (Rev. D) Beads (Glass Spheres) Retro-Reflective

FS TT-P-115 1999 (Rev. F) Paint, Traffic (Highway, White and Yellow)

MAINE DEPARTMENT OF TRANSPORTATION (MDOT) "Standard Specifications” 12/2002

1.4 SUBMITTALS

A. Manufacturer's Catalog Data

1. Reflective Media

2. Paint
3. Thermoplastic compounds and primer

B. Manufacturer's Instructions

1. Paint
2. Thermoplastic compounds and primer
3. Submit manufacturer's Material Safety Data Sheets.

C. Statements

1. Construction equipment list

D. Factory Test Reports

1. Reflective media
2. Paint
3. Thermoplastic compounds and primer
4. Report from sampling and testing made in accordance with paragraph entitled "Sampling and Testing".

E. Certificates of Compliance: Submit certificates attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the frequency or intervals specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1. Reflective media
2. Paint
3. Thermoplastic compounds and primer

1.5 DELIVERY AND STORAGE

A. Deliver paints, paint materials and thermoplastic compound materials in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer. Provide storage facilities at the job site for maintaining materials at temperatures recommended by the manufacturer.

1.6 SCHEDULES

A. Submit a written time schedule for traffic line painting. The schedule shall include paving and painting times. Provide the Architect/Engineer with 3-days notice prior to the application of any paint.

1.7 WEATHER LIMITATIONS

A. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 40-degrees F for oil-based materials, 50-degrees F for water-based materials, and less than 95-degrees F. Maintain paint temperature within these same limits.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials conforming to the requirements specified herein.

1. Paints for Roads and Streets: Paint shall be a cold-applied, alkyd base traffic marking paint in conformance with federal specifications FS TT-P-115, Type 1; FS TT-P-75, Maine State Standard, MDOT 708.03 and the following:

a. Color: White, Yellow
b. Finish: Flat
c. Drying Time: At 70-Degrees F (15 mils-wet)

1) To Touch: 12-minutes
2) To Recoat: 30-minutes
3) For Traffic: 30-minutes

d. Spread: 100-150-sq. ft. per gal. (15 mils wet) or 300’ of a 4” line at 15 mils wet
e. Flash Point: Under 80-Degrees F.
f. Viscosity (K.U.): 80-84
g. % Pigment by weight: 55% min.
h. Acceptable Products/Manufacturers are:

1) "Zoneline” Traffic and Zone Marking Paint by PPG Porter Paints of Porter International.
2) "Hotline" Fast Dry Latex Traffic Marking Paint by Sherman Williams.
3) Approved equal.

NOTE: Paint for temporary pavement marking shall retain the original color, adhere to the glass beads and shall be adequately durable to minimize the need for repainting.

2. Reflective Media for Roads and Streets: Shall be in conformance with FS TT-B-1325, Type I or II, Gradation A, and Maine State Standard MDOT 708.03 where glass beads conform to the requirements of AASHTO M247, Type I.

3. Thermoplastic Compounds: Thermoplastics are applied under heat.
a. Colors: as specified on the drawings
b. Thickness: 125mil minimum
c. Acceptable Products/Manufacturers are:

1) "Hottape” Preformed Thermoplastic Pavement Markings by Flint Inc.
2) Or similar as approved by the engineer

2.2 EQUIPMENT

A. Machines, tools, and equipment used in the performance of the work shall be approved by the Architect/Engineer and maintained in satisfactory operating condition.

B. Paint Applicator

1. Provide self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges. Provide equipment used for marking streets and highways capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines, or a combination of solid and intermittent lines using a maximum of three different colors of paint as specified. Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable air-driven mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Provide pneumatic spray guns for hand application of paint in areas where the mobile paint applicator cannot be used.

C. Reflective Media Dispenser: Attach dispenser for applying the reflective media to the paint dispenser and operate automatically and simultaneously with the paint applicator through the same control mechanism. Use dispenser capable of adjustment and designed to provide uniform flow of reflective media over the full width of the stripe at the rate of coverage specified herein at all operating speeds of the paint applicator to which it is attached.

D. Thermoplastic:
1. Magnum Torch or approved equivalent propane fueled torch with pressure regulator and 25 ft. of hose with adequate supply of propane
2. Infrared Thermometer
3. Gas powered blower or broom
4. Utility knife

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 20-days before application of marking materials. Pavement surfaces shall be dry and free of oil, dirt grease, and other contaminants prior to the application of pavement markings. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove rubber deposits, existing paint markings, residual curing compounds, and other coatings adhering to the pavement by waterblasting. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Clean non conforming surfaces to a width of 4 to 6 inches wider than the proposed marking. Do not commence painting in any area until pavement surfaces are dry and clean and have been inspected and approved by the Architect/Engineer.

3.2 APPLICATION

A. Widths: The traveled way or parking lane width and width of longitudinal lines shall be as specified on the drawings. Lane widths shall be measured from the center of the lane lines once a control line is established for the lane configuration of the roadway. When measurements are taken from existing longitudinal ilnes, the point of reference shall be the center of the single line or the center of the space between dual lines. The traveled way widths are in compliance when they have an acceptable appearance and are within a 2 inch variation from the proposed lane width.

B. Alignment: Place markings in a straight and uniform manner. Lane lines are in compliance when they have an acceptable appearance and are visually in alignment, with no more than a 3/8 inch variation in any 40 ft. section. Maintain longitudinal alignment through all intersections and breaks, even though the lines themselves may discontinue. Do not apply pavement line markings over longitudinal joints; offset the markings 2in.

C. Layout Markings: Remove layout markings that detract from the overall appearance and function of the final markings as determined by the engineer at no additional cost to the owner.
   1. Marking Removal: Remove existing pavement markings that conflict with new or altered traffic patterns. Use an approved method and ensure that the pavement surface is not damaged. (Using paint to cover conflicting paint lines is not an acceptable method) If damage occurs, repair or replace damages, to an acceptable manner equal or better than existing conditions, at no additional cost to the owner.

D. Rate of Application

   1. Reflective Markings: Apply paint evenly to the pavement area to be coated at a rate of 105 (plus or minus 5) square feet per gallon at a minimum of 15-mils of wet thickness. Apply glass spheres uniformly to the wet paint on road and street pavement at a rate of 6 (plus or minus 0.5)-pounds of glass spheres per gallon.
   2. Nonreflective Markings: Apply paint evenly to the pavement surface to be coated at a rate of 105 (plus or minus 5) square feet per gallon.

E. Painting: Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. Discontinue painting operations if there is a deficiency in drying of the markings until cause of the slow drying is determined and corrected.

F. Reflective Media: Application of reflective media shall immediately follow the application of paint. Accomplish drop-on application of the glass spheres to ensure even distribution at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, discontinue operations until deficiency is corrected.

G. Thermoplastic Compound: Place thermoplastic pavement markings upon dry pavement. At the time of installation the pavement surface temperature shall be a minimum of 40 degrees F and rising Prior to any heating. Rolled tape products shall be unrolled when the temperature is a sustained minimum of 55 degrees F. Thermoplastics, as placed, shall be free from dirt or tint. Heat the targeted surface area to 300 degrees F (or as specified by the manufacturer) immediately place the first piece. Apply all centerline, skipline, edgeline, and other longitudinal type markings with a mobile applicator. Maintain a minimum distance of 6 inches between the torch nozzle and the heat source. Place all special markings, crosswalks, stop bars, legends, arrows, and similar patterns with a portable applicator, using the extrusion method.

3.3 FIELD TESTING AND INSPECTION

A. Inspection: Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. A certificate of compliance shall be accompanied by test results substantiating conformance to the specified requirements.

1. Surface Preparations and Application Procedures: Surface preparations and application procedures will be examined by the Architect/Engineer to determine conformance with the requirements specified. Approve each separate operation prior to initiation of subsequent operations.

2. Records: Maintain complete records of quality control inspection results, including actions taken to correct problems. Identify the following for the record
   a. Ambient Temperature
   b. Pavement surface temperature
   c. Material Temperature
   d. Material Thickness
   e. Retroreflectivity
   f. Alignment
   g. Color
   h. Product name

3. Observation Period:
   a. The contractor shall be responsible for any defects in material and workmanship of the pavement markings for a period of 180 days from the date the pavement is opened to traffic.
   b. Time charges will not be assessed during the observation period provided all other work on the contract is complete. At the end of the observation period, the engineer can inspect the pavement markings for durability, color, and retroreflectivity, and inform the contractor that the pavement markings have failed and that they require corrective action. Pavement markings will be failed for any of the following conditions:
      1) More than 5 percent of the substrate is exposed in any section of longitudinal marking up to a 2,000 ft maximum inspection area.
      2) Retroreflectivity values have dropped below the minimum retroreflectivity specified.
      3) Marking is discolored when compared visually with the color chips.

      Remove and replace all failed markings within 30 days of receiving written notification from Engineer.

3.4 TRAFFIC CONTROL AND PROTECTION

A. Protect the markings until dry. Place warning signs (as per the MUTCD and as approved) near the beginning of the work site and well ahead of the work site for alerting approaching traffic from both directions. Place small markers along newly painted lines to control traffic and prevent damage to newly painted surfaces. Mark painting equipment with large warning signs indicating slow-moving painting equipment in operation. If a vehicle damages uncured markings, reapply the markings and removed the marks left on the pavement by the vehicle at no additional cost to the owner.

END OF SECTION 321226

SECTION 321313 – SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes exterior cement concrete pavement for the following:

1. Walkways
2. Equipment Pads
3. H.C. Ramps
4. Plaza areas
5. Granite Curbing

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Qualification Data: For manufacturer.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

1. Aggregates.

D. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, and supports for concrete reinforcement.

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Admixtures.
2. Applied finish materials.
3. Bonding agent or epoxy adhesive.
4. Joint fillers.
5. Saltguard Sealant

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete producer.
d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves with a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

C. Recycled Content of Steel Products: Provide products with an average recycled content of steel with postconsumer recycled content not less than 75 percent and preconsumer recycled content not less than 10 percent.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I or II.
2. Include Supplementary Cementitious Materials as a percentage of cementitious materials at 25% by weight:

a. Fly Ash: ASTM C 618, Class C or F.
b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Water: Potable.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Concrete Water Repellent Agent: Clear liquid concrete surface penetrating agent that protects concrete from moisture intrusions and chemical attack of chloride salts. Apply to all exterior concrete surfaces.

1. Available Products: PROSOCO, Inc.; Consolideck Saltguard WB

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. General site concrete:

1. Proportion mixtures to provide normal-weight concrete with the following properties:

a. Compressive Strength (28 Days): 3,000 psi.
b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
c. Slump Limit: 5 inches, plus or minus 1 inch.

2. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

a. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

C. Higher-strength site concrete:

1. Proportion mixtures to provide normal-weight concrete with the following properties:

a. Compressive Strength (28 Days): 4,500 psi.
b. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
c. Slump Limit: 4 inches, plus or minus 1 inch.

2. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

   a. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.8 CURBING

A. Granite Curbing: Stone for curbing and edging shall be approved granite from acceptable sources. The stone shall be hard and durable, predominantly gray in color, free from seams that impair its structural integrity and of smooth splitting character. Natural grain size and color variations characteristic of the source deposit will be permitted. Such natural variations may include bands or clusters of mineral or both of mineral crystallization that do not impair the structural integrity of the curb stone. The dimensions, shape and other details shall be as shown on the plans. Stone for curbing shall be granite in conformance with the following requirements.

1. Minimum depth of 6-inch curbing shall be 18-inches.
2. Curbing will be split faced on the sides with a smooth/rubbed finish on the tops.
3. Provide sound stone uniform in color, texture, and cut free from mineral stains, foreign water, and defects detrimental to appearance and durability.
4. Color range, texture, and finish cut of stone materials shall be within range of existing stone curbing as approved by the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
2. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Control Joints: From weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints by sawcutting for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of control joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

O. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

P. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 CURBING

A. Granite Curbing: Install curbing in conformance with City of Portland Technical Design Standards. Specifications are as follows unless otherwise indicated on the Drawings.

3.8 CONCRETE FINISHING

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route or as specified on the construction plans. Coordinate required final finish with Architect before application.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

E. All exterior concrete surfaces shall be provided with a water repellent product equal to Consolideck Saltguard WB. Apply product per manufacturer's recommendations.

3.10 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: The Site Contractor shall pay for any required retesting by the Architect and Owner.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321316.23 - STAMPED CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Dry-shake colored hardener applied to exterior concrete paving surfaces as indicated on Drawings.
2. Stamping concrete patterns with special imprinting tools.
3. Curing of colored and imprinted concrete.

B. Related Sections:

1. Section 321313 “Site Concrete” for general concrete applications.
2. Section 321373 “Concrete Paving Joint Sealants” for colored sealant installed in paving joints.

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301: Specification for Structural Concrete for Buildings.
2. ACI 302.1R: Recommended Practice for Concrete Floor and Slab Construction.
3. ACI 303.1: Standard Specification for Cast-in-Place Architectural Concrete.
4. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete.
5. ACI 305R: Recommended Practice for Hot Weather Concreting.
6. ACI 306R: Recommended Practice for Cold Weather Concreting.

B. ASTM International (ASTM):

1. ASTM C 260: Standard Specification for Air Entraining Admixtures for Concrete.
2. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM C 979: Standard Specification for Pigments for Integrally Colored Concrete.

C. Portland Cement Association (PCA):

1. PA124: Finishing Concrete with Color and Texture.

1.3 SUBMITTALS

A. Product Data: For the following products:.

1. Dry-shake colored hardener.
2. Liquid release agent.
3. Imprinting/Texturing tools.
4. Curing compound and sealer.

B. Design Mixes: For each type of concrete.

C. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.

D. Qualification Data: For manufacturer and Installer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products.

B. Installer Qualifications: Minimum 5 years of documented experience with work of similar scope and complexity required by this Project and acceptable to, or certified by, stamped concrete paving manufacturer.

C. Publications: Comply with applicable requirements of ACI 301 and PCA PA124.

D. Material Source: Obtain each specified material from the same source.

E. Notification: Give a minimum 7 calendar days' notice to manufacturer's authorized field representative before date established for commencement of work.

F. Stamped Concrete Paving Mockups:

1. Construct a 10 foot by 10 foot mockup at location selected by Architect.
2. Provide individual mockups for each color and pattern required.
3. Construct mockup using materials, processes, and techniques required for the work, including curing procedures. Incorporate representative control, construction, and expansion joints according to Project requirements. Installer for the work to construct mockup.
4. Notify Architect and Owner a minimum of seven calendar days in advance of the date scheduled for each mockup construction.
5. Obtain the Architect's and Owner's acceptance of each mockup prior to commencement of the work.
6. Each mockup to remain until completion of the work to serve as a quality control standard for the work. Provide suitable protections to preclude damage to mockup.
7. Demolish and remove each mockup from site when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration date as applicable.

B. Store products in a location protected from damage, construction activity, and adverse environmental conditions according to manufacturer's current recommendations.

1. Imprinting tools must be stored flat, textured face up, with no objects resting on top.

C. Handle products according to manufacturer's printed instructions.

1.6 PROJECT CONDITIONS

A. Schedule placement to minimize exposure to wind and hot sun before curing materials are applied.

B. Do not place concrete if rain, frost, or snow is forecast within 24 hours of placement. Protect fresh concrete from moisture and freezing conditions.

C. Compliance Standards: ACI 305R and ACI 306R.

1.7 PREINSTALLATION CONFERENCE

A. Seven calendar days prior to scheduled date of concrete placement, conduct a meeting at Project site to discuss requirements, including application methods. Attendees to include Architect, Owner, Contractor, Installer, concrete supplier, and manufacturer's authorized field representative.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Provide products specified herein manufactured by L. M. Scofield Company (Scofield).

2.2 MATERIALS

A. Dry-Shake Colored Hardener: Cementitious material containing special hard aggregates, formulated as a high opacity color hardening material for the top surface of freshly place concrete substrates. Highly UV-resistant. Factory proportioned, mixed and packaged, ready-to-use. Comply with ASTM C 979.

1. Product: Scofield's "LITHOCHROME Color Hardener."
2. Colors: Brick Red.
3. Imprinting Tools: System of matched tools for imparting textures and patterns into freshly placed concrete surfaces.
4. Product: Scofield's "LITHOTEX Pavecrafters."
5. Patterns: New Brick Running Bond.

B. Low VOC Liquid Release Agent: Colorless, odorless liquid formulated to break the bond between imprinting tools and surface of color-hardened concrete. Evaporates completely, leaving no residue. VOC content less than 450 g/L (3.75lb/gal).

1. Product: Scofield's "LITHOTEX Liquid Release."

C. Waterborne Curing Compound and Sealer: Low VOC waterborne modified acrylic formulation. Complies with ASTM C 309.

1. Product: Scofield's "SCOFIELD Cureseal-W."

2.3 CONCRETE MIX DESIGN

A. General: Refer to Section 321313 “Site Concrete” for basic concrete paving requirements, including formwork, reinforcement, concrete materials, and mixing.

B. Minimum Cement Content: 5-1/2 sacks per cubic yard of concrete.

C. Mix design must not permit segregation of concrete materials during pumping, placing, or consolidation of concrete. Slump not to exceed 4 inches.

D. Admixtures:

1. A normal or retarded-set, water-reducing admixture is permissible.
2. An air-entraining admixture complying with ASTM C 260 is acceptable where freeze/thaw durability is required.
3. A nonchloride accelerator is acceptable for cold weather concrete placement.
4. Do not add a high-range water reducing admixture (superplasticizer).

E. Do not add calcium chloride to concrete mix.

F. Use of fly ash as a cement replacement may be acceptable, subject to manufacturer’s current recommendations.

G. Do not add water to the mix in the field.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

A. Subgrade to receive stamped concrete paving work must be well drained and have adequate, uniform loadbearing characteristics.

1. Verify grading will ensure a uniform concrete thickness during concrete placement.

B. At the time of concrete placement, subgrade must be moist, completely consolidated, and free from frost. If necessary, subgrade may be dampened with water prior to placement; however, freestanding water or soft, muddy, or frozen ground in not permissible.

3.2 CONCRETE PLACEMENT

A. General: Place and spread concrete to completely fill all space inside forms. Move concrete into place with square-tipped shovels or concrete rakes.

B. Consolidate concrete by tamping or vibrating to provide a suitable surface for finishing.

C. Prior to appearance of excess moisture or bleed water, screed concrete with wood or magnesium straight edge or mechanical vibrating screed.

D. Continue concrete surface leveling and consolidation with highway magnesium straight edge and (or) magnesium bull float.

E. Mechanically float concrete surfaces to required flatness and levelness as soon as concrete surface has taken its initial set and will support weight of a power float machine equipped with float shoes or combination blades and operator.

1. Comply with ACI 302.1R for acceptable tolerances.

F. Completed concrete placement to result in an open surface suitable to receive colored hardener.

3.3 STAMPED CONCRETE PAVING INSTALLATION

A. Apply 2/3 of dry-shake colored hardener at specified application rate to freshly floated concrete surface. Bleed water must not be present during or following application of first and second dry-shake applications.

B. Do not throw dry-shake colored hardener material; distribute evenly by hand or mechanical spreader designed to apply floor hardeners. Mechanical spreader manufacturer as acceptable to stamped concrete paving manufacturer.

C. As soon as dry-shake material has absorbed moisture, indicated by uniform darkening of surface, mechanically float concrete surface a second time, just enough to bring moisture from base slab through dry-shake color hardener.

D. Immediately following second floating, apply remaining 1/3 of dry-shake colored hardener at specified application rate. If applied by hand, broadcast in opposite direction of first application for a more uniform coverage. If a mechanical spreader is used, apply in same manner as previously described.

E. As soon as dry-shake material has absorbed moisture, mechanically float concrete surface a third time.

F. Do not add water to the surface.

G. Begin imprinting operations immediately after applying dry-shake colored hardener, according to manufacturer's written instructions, including application of powder antiquing release agent.

3.4 SEALING

A. Prior to sealing, the following conditions must be present:

1. Release agent has been removed.
2. Moisture content of concrete is low enough that alkali and other salts do not become trapped beneath sealer. This will require a minimum of 28 days subsequent to concrete placement, or longer if required.
3. No evidence of free water on concrete surfaces to receive curing and sealing compound.

B. Seal imprinted concrete with liquid membrane curing and sealing compounds as recommended by manufacturer.

C. Apply two coats of specified curing and sealing compound according to manufacturer's written instructions.

3.5 PROTECTION OF FINISHED WORK

A. Prohibit foot or vehicular traffic on the newly imprinted concrete surface.

B. Protect floor surface from damage throughout remainder of construction period until Final Acceptance of the work. If a covering material is necessary, surfaces must remain uncovered for a minimum of four days after which they may be covered with a new, smooth, nonstaining reinforced kraft curing paper. Plastic sheeting is unacceptable as a covering material.

3.6 SCHEDULE

A. Refer to Drawings for locations of stamped concrete paving applications.

END OF SECTION 321316.23

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
2. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
3. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: Match color of finished concrete.

2.2 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.3 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION 321373

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Brick pavers set on sand/cement.
2. Bedding and joint sand.

B. Related Sections:
1. Division 32 Section "Asphalt Paving" for asphalt base under unit pavers.
2. Division 32 Section "Site Concrete" for cast-in-place concrete curbs and gutters serving as edge restraints for unit pavers.

1.3 ACTION SUBMITTALS

A. Shop or product drawings and product data shall be submitted. The layout, pattern, and relationship of paving joints to fixtures and project formed details shall be indicated.

B. Test results shall be submitted from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.

C. Product Data: For the following:

1. Pavers.
2. Sand/Cement setting materials.

D. Samples for Verification:

1. Full-size units of each type of unit paver indicated.

E. Sieve Analyses: For setting-bed materials, according to ASTM C 136.

1.4 QUALITY ASSURANCE

A. Installation shall be by a contractor and crew with at least one year of experience in placing clay pavers on projects of similar nature or dollar cost.

B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. A 9 ft. x 9 ft. paver area shall be installed as described in Article 3.6.
2. This area will be used to determine joint sizes, lines, laying pattern(s), color(s), and texture of the project.
3. This area shall be the standard from which the work will be judged.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.6 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

PART 2 - PRODUCTS

2.1 BRICK PAVERS

A. Clay Brick Pavers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include:

1. Pine Hall Brick, Pathway Full Range.
2. Thickness: 2-1/4 inches .
3. Face Size: 4 by 8 inches .
4. Color: Pathway Full Range

B. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.

BEDDING SAND GRADING REQUIREMENTS

ASTM C 33

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 - 100
No. 8 (2.36 mm)	85 - 100
No. 16 (1.18 mm)	50 - 85
No. 30 (600 µm)	25 - 60
No. 50 (300 µm)	10 - 30
No. 100 (150 µm)	2 - 10

End of Table2 -

2.2 JOINT SAND

A. Joint sand shall be Unicare Polymeric Sand Max by Unilock or approved equal.

B. Color: Grey

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Verify that subgrade preparation, compacted density and elevations conform to the specifications.

D. Verify that geotextiles, if applicable, have been placed according to specifications and drawings.

E. Verify that aggregate subbase materials, thickness, compaction, surface tolerances and elevations conform to the specifications.

F. Verify that the asphalt base is ready to install the bituminous bedding layer.

G. Beginning the installing of the sand/cement bedding layer and paver installation shall signify acceptance of the asphalt base.

3.2 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed indicated by manufacturers.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: As indicated on drawings.

E. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

3.3 AGGREGATE SETTING-BED APPLICATIONS

A. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.

B. Treat leveling course with herbicide to inhibit growth of grass and weeds.

C. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.

1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.

D. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.

1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.

E. Fill joints immediately after vibrating pavers into leveling course.

F. Do not allow traffic on installed pavers until sand has been vibrated into joints.

3.4 PAVER JOINTS

A. Install joint sand per manufacturers recommendations.

B. Repeat joint-filling process 30 days later.

3.5 OTHER CONDITIONS

A. Place a pre-molded, non-extruded, and resilient expansion joint against all vertical walls with flashing to within one (1) inch of finished grade.

3.6 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321400

SECTION 323900 - SITE ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes site accessories.

B. Related sections:

1. Section 013300, Submittal Procedures.
2. Section 312000, Earth Moving for Structures and Pavements.
3. Section 312100, Earth Moving for Utilities.
4. Section 321216, Asphalt Paving
5. Section 321313, Site Concrete.
6. Division 26, Electrical Systems
7. Section 323113, Chain Link Fences and Gates.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A123 2008 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

1.4 SUBMITTALS

1. Manufacturer's Catalog Data

    a. Pipe bollard
    b. Plastic Pipe Bollard Sleeve
    c. Precast Concrete Light Pole Bases
    d. Tactile Warning Surface

2. Color Selection Samples

    a. Pipe bollard
    b. Plastic Pipe Bollard Sleeve
    c. Tactile Warning Surface

3. Shop Drawings

   a. Pipe Bollard
   b. Precast Concrete Light Pole Bases

4. Certificates of Compliance: Submit certificates attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the frequency or intervals specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

   a. Cast In Place Concrete
   b. Precast Concrete

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. Deliver, store, and handle site accessories to prevent damage and deterioration.

1.6 SITE CONDITIONS

A. General: Do not begin site accessory work before completion of final grading or surfacing.

B. Existing Conditions: The Contractor shall verify existing site conditions prior to commencing the work. The Contractor shall insure that all prior work required prior to the installation of the work shall be coordinated and completed properly.

C. Field Measurements: The Contractor shall employ qualified personnel to determine and layout the proper location of new work as indicated on the drawings, as specified herein, or in a manner conforming with industry standards.

1.7 SEQUENCING AND SCHEDULING

A. The Contractor shall coordinate and sequence all work with other disciplines and with other work shown on the drawings or specified.

1.8 WARRANTY

A. The Contractor shall provide the Owner with a copy of all manufacturers warrantees. The conditions of the warrantee approvals shall be completed by the Contractor. The Contractor shall guarantee all work for one year from the date of project completion, determined as the date at which the completion documentation is approved by the Architect/Engineer.

1.9 MAINTENANCE

A. General: The Contractor shall perform all manufacturer required maintenance work unless specified otherwise within this section. The maintenance period shall terminate at the same time as the one-year warranty period.

B. Maintenance Service: the Contractor shall pay for the cost of maintenance work provided by suppliers, outside consultants or contractors during the warranty period. A copy of the maintenance contract shall be provided with the operations and maintenance manual.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe Bollards

1. Bollard shall be Schedule 40 galvanized steel pipe 6" O.D.
2. Primer paint and finish paint with exterior oil base paint. Color selected by Architect.
3. Bollard set in concrete footing. See Drawing and refer to Section 321313.

B. Precast Concrete Light Pole Bases

1. Precast, air-entrained concrete, 4000-psi minimum compressive strength, provide rebar as indicated on the drawings.
2. Size and dimensions as indicated on Drawings. Verify the size with light pole selected. The top of footing shall not be located above frost depth.
3. Provide chamfered edges at top of base.
4. Provide electrical conduit as required.
5. Coordinate bolt size and pattern with light pole selected
6. Acceptable manufacturers are American Concrete or approved equal

C. Plastic Pipe Bollard Sleeve

1. Plastic sleeve shall be ¼" wall thickness, LDPE with UV inhibitors and anit-static properties sized to slip over the steel pipe bollard
2. Color selected by Architect.
3. Sleeve shall be fastened to steel bollard with galvanized screw two inches up from the base of the sleeve. One on either side of the base.
4. Basis of Design: Dawn Enterprises Model #: BCP6DQ for a 6" bollard. (distributed by bigbollards.com)

D. Tactile Warning Surface

1. Tactile warning surface shall be composite wet set (replaceable) detectable warning panels manufactured by ADA Solutions or equal approved by the City of Portland Department of Public Services.
2. Must be ADA compliant
3. Color shall be "dark gray" colored (#36118).
4. Surface will be set in concrete with preformed inset. See drawing and refer to Section 321313.
5. Surface will be attached to concrete as recommended by manufacturer and shall be either stainless-steel flat head screw or adhesive recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination of Work

1. The Contractor shall coordinate installation of items outlined in this section with other sections to insure that items are not placed in temporary delivery/travel ways, loading zones, areas subject to disposal of or falling debris or otherwise locate structures in temporary construction zones.

B. Surface Preparation:

1. Remove loose material and debris from base surface before placing site accessories.
2. Locate and layout all site accessory items. Obtain Architect's acceptance of layout prior to installation.
3. Complete any other preparation as required per the manufacturers specifications.

3.2 INSTALLATION

A. Pipe Bollard: Install as shown and detailed on the contract drawing. Pipe bollards shall be set plumb and to the line and grade shown on the drawings.

B. Plastic Pipe Bollard Sleeve: Install per the manufacturers recommendations. Secure the sleeve to the steel bollard with a screw two inches from the base on each side of the sleeve.

C. Precast Concrete Light Pole Bases
1. Install light pole base on suitable undisturbed native soil or compacted structural fill.
2. Verify that the pole depth below grade exceeds frost depth for that location. Verify that the light pole base reveal above grade is in accordance with the reveal specified on the drawings.
3. Connect electrical conduit as needed.
4. Check that the light pole base is level and plumb.
5. Provide 12” minimum surround of compacted granular fill

D. Tactile Warning Surface: Install per the manufacturers recommendations and City of Portland Technical Specifications.

E. Tolerances

1. Finish grade shall comply with requirements of Section 312000.
2. Vertical elements shall be set plumb and level.

3.3 FIELD QUALITY CONTROL

A. Inspection: Examine subgrades, finished surfaces, and installation conditions. Do not start site accessories work until unsatisfactory conditions are corrected.

3.4 ADJUSTING

A. Adjust all items until accepted by Architect/Engineer.

3.5 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from site accessories work.

3.6 PROTECTION

A. The Contractor shall temporarily barricade or otherwise prevent access to or damage resulting from travel across or near site accessories.

END OF SECTION 323900

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Seeding.
2. Hydroseeding.
3. Sodding.
4. Turf renovation.
5. Erosion-control material(s).

B. Related Sections:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 312000 "Earth Moving" for excavation, filling and backfilling, and rough grading.
3. Section 329300 "Plants" for border edgings.
4. Section 334600 "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture as recommended by testing agency.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified landscape Installer.

B. Product Certificates of Compliance: For soil amendments and fertilizers, from manufacturer.

C. Material Test Reports: For topsoil.

D. Seeding Schedule: Provide seeding schedule to Landscape Architect a minimum of 10 days prior to activity.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:

    a. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
    b. Certified Turfgrass Professional, designated CTP.
    c. Certified Turfgrass Professional of Cool Season Lawns, designated CTP-CSL.

5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.

    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 15th – June 15th.
2. Fall Planting: August 15th – September 30th.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.9 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 30 days from date of Substantial Completion.

1.10 WARRENTY

A. Provide an 90% catch of grass (turf) by watering, mowing, and maintaining seeded areas until final acceptance. Reseed areas, with specified materials, which fail to provide an 90% catch of grass or where excess flow of water has caused seed to wash away until all affected areas are accepted by the Landscape Architect. Do not remove siltation fences until an approved uniform stand of grass is achieved.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species as follows:

C. Seed Species: Seed of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

a. Lawn Areas – equal mix of 3 dwarf tall fescue

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
3. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

2.4 FERTILIZERS

A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.5 TOPSOIL

A. Provide material free of subsoil, stumps, rocks larger than 3/4-inch diameter (with maximum 3-percent retained on 1/4-inch screen), brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity. Modify topsoil provided if necessary conform with the requirements specified in Table II.

Provide additional topsoil from approved sources off the site meeting the requirements described in Table II if on-site stockpiled material is not sufficient to complete all indicated work.

PLANTING SOIL

TABLE II

DOA SSIR Soil Survey Investigation Acceptable Report No. 1, Laboratory Test for:	Acceptable Limits
Sand Content	20 to 75-percent by weight
Silt Content	10 to 60-percent by weight
Clay Content	5 to 30-percent by weight
Organic Material (Walkley-Black)	1.5-percent
Ph	5.5 to 7.0
Soluble Salts	600-ppm maximum
Absorption Rate	0.5-inch per hour minimum

2.6 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

D. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.7 PESTICIDES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

C. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of 4-inch nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

1. Products: Subject to compliance with requirements, provide the following:

a. Mirafi 700X

b. Supergro or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.

2. Spread planting soil to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately 1/2 the thickness of planting soil over loosened subgrade. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.
b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.
2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at manufacturers recommended rate for seed type.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.7 TURF RENOVATION

A. Renovate existing turf.

B. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).

I. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.

J. Apply seed and protect with straw mulch as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow to a height of 3 inches.

D. Turf Post fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

C. If at the end of three weeks a satisfactory of grass has not been produced, the contractor shall renovate and reseed the lawn or unsatisfactory portions thereof immediately or, if after the acceptable planting during the requirements of this specification.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Planting soils.
3. Tree stabilization.

B. Related Sections:

1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
3. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
4. Division 32 Section "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

D. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

G. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

H. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

I. Planting Area: Areas to be planted.

J. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

K. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

L. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

M. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including soils.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.

B. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

1. Manufacturer's certified analysis of standard products.

C. Material Test Reports: For imported or manufactured planting and topsoil.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

D. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

C. Handle planting stock by root ball.

D. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly-wet condition.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 15th - June 15th.
2. Fall Planting: August 15th – September 20th.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

D. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods from Date of Substantial Completion:

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

2.2 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.

G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.3 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

2.4 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Planting Tablets: Tightly compressed chip type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.5 PLANTING SOILS

A. Planting Soil: Amended topsoil meeting requirements of testing. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from bogs, or marshes.

2.6 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Dark Bark shredded wood.
2. Color: Dark Brown.

2.7 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.

2.8 TREE STABILIZATION MATERIALS

A. Root-Ball Stabilization Materials:

1. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball; sized per manufacturer's written recommendations unless otherwise indicated.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Border Concepts, Inc.; Tomahawk Tree Stabilizers.
2) Foresight Products, LLC; Duckbill Rootball Fixing System.
3) Tree Staple, Inc.; Tree Staples.

2.9 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

3.3 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for balled and burlapped, container-grown stock.
2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
3. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
4. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
5. Maintain supervision of excavations during working hours.
6. Keep excavations covered or otherwise protected after working hours.

B. Subsoil and topsoil removed from excavations must be amended to meet testing agency requirements prior to being used as planting soil.

C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

3.4 TREE, SHRUB, AND VINE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Use planting soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set container-grown stock plumb and in center of planting pit or trench with root flare 1 inch adjacent finish grades.

1. Use planting soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets in each planting pit when pit is approximately one-half filled; in amounts recommended in soil reports from soil-testing laboratory. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

F. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than the manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

3.5 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Do not apply pruning paint to wounds.

3.6 TREE STABILIZATION

A. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and according to manufacturer's written instructions.

3.7 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.8 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.11 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section covers work related to storm collection and conveyance systems shown on drawings and specifications.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities procedures.
2. Division 22 Section "Plumbing" for roof drain connections.
3. Division 32 Section "Turf and Grasses, Plants" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.
4. Division 31 Section "Earth Moving for Utilities" for soil materials, excavating, backfilling.
5. Division 31 Section "Dewatering" for requirements and guidelines for dewatering procedures.
6. Division 31 Section “Excavation Support and Protection" for requirements and guidelines for dewatering procedures.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M198	1998 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	1988 Concrete Pipe Handbook
ACPA 01-103	1978 Concrete Pipe Installation Manual

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

ANSI A14.3	2008 Ladders - Fixed – Safety Requirements

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA MRE-CHP.1-5	1993 Manual for Railway Engineering (Fixed Properties): Chapter 1, Part 5, Pipelines

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A48	2003 (Rev. 2008) Gray Iron Castings
ASTM A525	1987 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A536	1984 (Rev. 2004) Ductile Iron Castings
ASTM A760	2006 Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A762	2008 Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A798	2007 Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A819	1984 Steel Sheet, Aluminum-Coated Type 2 for Storm Sewer and Drainage Pipe
ASTM A849	2000 (Rev. 2005) Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM B745	1997 (Rev. 2005) Corrugated Aluminum Pipe for Sewers and Drains
ASTM B788	2004 Installing Factory-Made Corrugated Aluminum Culverts and Storm Sewer Pipe
ASTM C14	2007 Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe
ASTM C76	2008 (Rev. A) Reinforced Concrete Culvert Storm Drain and Sewer Pipe
ASTM C109	2008 Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)
ASTM C150	2007 Portland Cement
ASTM C361	2008 Reinforced Concrete Low Head - Pressure Pipe
ASTM C443	2005 (Rev. A) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C478	2009 Precast Reinforced Concrete Manhole Sections
ASTM C923	2008 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM D1784	2008 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2680	2001 (Rev. 2009) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping

ASTM D2729	2003 Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3034	2008 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	2007 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D4101	2008 Polypropylene Plastic Injection and Extrusion Material
ASTM F402	2005 Safe Handling of Solvent Cements Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F2648	2007 2 to 60 inch Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS D1.1	1992 Structural Welding Code Steel

FEDERAL SPECIFICATIONS (FS)

A-A-60005	(Rev. 2) Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
FS TT-C-490	2002 (Rev. E) Cleaning Methods for Ferrous Surfaces and Pretreatments for Organic Coatings

MILITARY SPECIFICATIONS (MIL)

DOD-P-15328	(Rev. D) (Amd. 1) Primer (Wash), Pretreatment, (Formula No. 117 for Metals) (Metric)

UNI-BELL PLASTIC PIPE ASSOCIATION (UNI)

UNI B51989 Installation of Polyvinyl Chloride (PVC) Sewer Pipe (Replaced by ASTM D2321)

1.4 SUBMITTALS

A. Manufacturer's Catalog Data

1. Pipes (each type)
2. Fittings
3. Joints and couplings
4. Cleanouts

B. Drawings

1. Precast concrete manholes/catch basins
2. Metal work
3. Trench drain components

C. Certificates of Compliance: Submit certificates attesting that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the frequency or intervals specified

in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates on the same type, class, grade, and size of material as is being provided for the project.

1. Pipe and fittings, including factory-applied linings
2. Pipe joint materials
3. Ductile-iron frames, covers, and gratings
4. Precast concrete manhole sections/catch basins
5. Trench drain components

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage

1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
3. Cement, Aggregates, and Reinforcement: Store as specified in Section 033000, "Cast-In-Place Concrete."

B. Handling: Handle pipe, fittings, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care not to damage coating and paving on pipe and fittings; if damaged, make repairs. Carry, do not drag pipe to trench.

PART 2 - PRODUCTS

2.1 PIPELINE AND CULVERT MATERIALS

A. Hdpe Composite Plastic Piping

1. Hdpe Composite Plastic Pipe and Fittings: High Density Polyethylene (Hdpe) composite pipe and fittings.

   a. Hancor "Hi-Q" or "Titeline".

   The prescribed sizes of pipes are nominal inside diameter. Pipes shall be of the size and length shown on the drawings.

2. Corrugated Polyethylene Pipe: The products supplied under this specification shall be high density polyethylene corrugated exterior/smooth interior pipe. 4 through 60 inch shall meet ASTM F2648. Material for pipe production shall be an engineered compound of virgin and recycled high density polyethylene conforming with the minimum requirements of cell classification 424420C (ESCR Test Condition B) for 4- through 10-inch diameters, and 435420C (ESCR Test Condition B) for 12- through 60-inch diameters, as defined and described in the latest version of ASTM D3350, except that carbon black content should not exceed 4%.
3. Joint and Fittings: Pipe joints and fittings shall conform to ASTM F2306, AASHTO M252 or AASHTO M294, or be approved by the Engineer.

B. Composite Plastic Piping

1. ABS Composite Plastic Pipe and Fittings: Acrylonitrile-Butadiene Styrene (ABS) or Poly(Vinyl Chloride) (PVC) composite pipe and fittings, ASTM D2680.
2. Jointing Materials for ABS Composite Plastic Piping: ASTM D2680 solvent cement and primer or ASTM D3212 elastomeric gasket joints. Ends of pipe and fittings shall be suitable for either Type SC or Type OR joints.

C. Polyvinyl Chloride (PVC) Plastic Piping

1. PVC Plastic Pipe and Fittings: Provide bell and spigot type PVC pipe in sizes, locations, and at grades as indicated on the Drawings. Pipe shall conform to ASTM D3034 for SDR 35 pipe; PVC resin compound shall conform to ASTM D1784; lock in rubber sealing rings shall conform to ASTM D3212 and ASTM D477. Standard laying lengths shall be 12.5-feet. All joints shall be flexible providing for linear expansion and contraction. Provide manufacturer's standard lubricant. Acceptable products/manufacturers are:

   a. Ipex Inc
   b. North American Pipe
   c. Hancor
   d. Or approved similar or equal.

D. Detection Materials: Provide detectable tape, or detection plates at all buried clean outs.

2.2 CONCRETE MATERIALS

A. Precast Concrete and Associated Materials

1. Precast Concrete Manhole Sections: Precast concrete manhole risers, base sections, and tops shall conform to ASTM C478. Base and first riser shall be monolithic. All concrete shall have a minimum compressive strength of 4,000 - psi at 28-days. Components shall be designed for a H-20 wheel loading and reinforced to 0.12-in. sq./ft. Honched concentric cones shall be designed for use with square frames and grates unless otherwise indicated on the Drawings. Base shall be monolithic construction. Provide precast setting sections "Doughnuts," for frames as shown on the Drawings. Set frames with mortar as covered in paragraph - "Joint Mortar." Acceptable products/manufacturers are:

   a. American Concrete Industries.
   b. Superior Concrete Co., Inc.
   c. Approved equal.

2. Type "F" Catch Basin: Provide Type "F" catch basins where located on the drawings. Catch basin shall be a precast square catch basin in sizes as shown on the drawings designed for an H-20 wheel loading. Provide outlet in location and elevation as indicated on the drawings. Concrete for catch basins shall have a minimum compressive strength of 4,000 psi at 28-days, and shall be reinforced with welded wire mesh acceptable products/manufacturers are:

   a. “Type 'F' CB" by American Concrete Industries.
   b. Superior Concrete Co., Inc.
   c. Approved equal.

3. Gaskets and Connectors: Gaskets for joints between manhole sections shall conform to ASTM C443. Resilient connectors for making joints between manhole and pipes entering manhole shall conform to ASTM C923.

B. Metal Items

1. Frames, Covers, and Gratings: Unless otherwise indicated on the drawings or specified, frames, covers and gratings shall be gray cast iron conforming to ASTM A 48/A 48M -03, Class 30B and suitable for AASHTO H 20-44 and HS 20-44 highway loading.

2. Catch Basins: Unless otherwise indicated on drawings, standard frames and grates shall be provided. Acceptable products/manufacturers shall be:
   a. STANDARD: General Foundries 22484-SQH-USA (24" square grate with 8" deep frame) or approved equal;
   b. CASCADE: General Foundries 22484-CAS-USA (24" square grate with 8" deep frame) or approved equal;
   c. BEEHIVE: Neenah R-2560-E5 (25.75" diameter with 8" deep frame) or approved equal;
   d. Or as otherwise specified on drawings.

3. Manholes: Provide non-skid surface with raised letter "DRAIN" designation cast on the cover. Acceptable products/manufacturers shall be:
   a. Etheridge E24X5 cast iron manhole frame and cover or approved equal

4. Drainage Structure Steps: Zinc-coated steel conforming to ANSI A14.3. As an option, plastic or rubber coating pressure-molded to the steel may be used. Plastic coating shall conform to ASTM D4101, copolymer polypropylene. Rubber shall conform to ASTM C443, except shore A durometer hardness shall be 70 plus or minus 5. Aluminum steps or rungs will not be permitted. Provide steps in manholes or catch basins greater than 4 feet deep.

C. Patching Mortar: Provide a hydraulic cement-base, quick-set, mortar at repairable damage sections and pipe openings in catch basins. Provide mortar in conformance with the following:

TEST	RESULT
Compressive Strength (ASTM C109)	20 minutes = 2142-psi
	1-day = 4383-psi
	7-days = 5334-psi
	28-days = 5833-psi
Tensile (ASTM C190)	20-minutes = 210-psi
	1-day = 270-psi
	7-days = 320-psi
	28-days = 370-psi
Flexural (ASTM C348)	7-days = 650-psi
	28-days = 370-psi
Push Out Load	Greater than 6000 psi

1. "Water Plug" by Thoro System Products
2. Approved equal.

D. Joint Mortar: The cement for mortar shall conform to the requirements of Portland cement AASHTO M85, Type II or IIA. Joint mortar shall consist of 1-part Portland cement, 2 parts sand and sufficient water to obtain the required consistency. Mortar shall be used within 30-minutes after its preparation.

E. Cast-in-place concrete applications: refer to section 321313 Site Concrete.

2.3 TRENCH DRAIN COMPONENTS

A. Trench drain units

1. Trench drain units shall be modular HDPE channels with tongue and groove connections encsed in concrete..

2. Grates shall be galvanized ductile iron with inlet slots perpendicular to direction of flow.
3. Acceptable products/manufacturers are:

a. Zurn Z874 wide throat trench drain system
b. Approved equal.

B. Catch basins for trench drain system shall be of HDPE encased in concrete, designed to accommodate trench drain channels. Catch basins shall contain a stainless steel trash basket. Grates shall be of galvanized ductile iron with same inlet slot pattern as trench drain units.

1. Acceptable products/manufacturers are:

a. Zurn Z874 trench drain system
b. Approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPELINES AND APPURTENANT CONSTRUCTION

A. General Requirements for Installation of Pipelines: These requirements shall apply to pipeline installation except where specific exception is made under paragraph entitled "Special Requirements."

1. Location: The work covered by this section shall terminate at a point approximately 10 feet from the building, unless otherwise indicated on the drawings.
2. Earthwork: Perform earthwork operations in accordance with Section 312100, "Earth work for Utilities."
3. Pipe Laying and Jointing: Inspect each pipe and fitting before and after installation; remove those found defective from site and replace with new. Provide proper facilities for lowering sections of pipe into trenches. Lay pipe with the bell ends in the upgrade direction. Adjust spigots in bells to produce a uniform space. Blocking or wedging between bells and spigots will not be permitted. Replace by one of the proper dimensions any pipe or fitting that does not allow sufficient space for proper calking or installation of joint material. At the end of each workday, close open ends of pipe temporarily with wood blocks or bulkheads. Provide batterboards not more than 25 feet apart in trenches for checking and ensuring that pipe invert elevations are as indicated. Laser beam method may be used in lieu of batterboards for the same purpose.
4. Connections to Existing Lines: Notify Architect/Engineer in writing at least 10 days prior to date that connections are to be made. Obtain approval of the Architect/Engineer before interrupting service. Conduct work so that there is minimum interruption of service on existing line.

B. Special Requirements

1. Installation of ABS or PVC Composite Plastic Piping: Install pipe and fittings in accordance with the "General Requirements for Installation of Pipelines" and with the recommendations of the plastic pipe manufacturer. Make joints with the primer and solvent cement specified for this joint; assemble in accordance with the recommendations of the pipe manufacturer. Handle solvent cement in accordance with ASTM F402.
2. Installation of PVC Plastic Piping: Install pipe and fittings in accordance with the "General Requirements for Installation of Pipelines" and with the requirements of UNI B5 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping; assemble in accordance with the requirements of UNI B5 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
3. Installation of PVC Plastic Piping, Fittings, and Saddles: Install pipe and fittings in accordance with the "General Requirements for Installation of Pipelines" and with the requirements of UNI B5 for laying and jointing pipe and fittings. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer. Make joints with the gaskets specified for joints with this piping; assemble in accordance with the requirements of UNI B5 for assembly of joints and as follows:

    a. Clean all foreign material from bell and rubber ring.
    b. Clean pipe spigot end from all foreign material.
    c. Lubricate spigot end of pipe using pipe manufacturers recommended lubricant. Cover entire spigot end circumference. Coating should be equivalent to one coat of enamel paint. (Keep out of dirt).
    d. Insert spigot end into the bell so that it is in contact with the rubber ring. Keep the pipe lengths in proper alignment.
    e. Follow manufacturer's written installation instructions in strict accordance.

C. Concrete Work: Perform cast-in-place concrete work in accordance with Section 033000, "Cast-In-Place Concrete", and the following:

1. Concrete Cradles (Thrust Blocks): Provide in locations and configurations as indicated on the drawings. Minimum compressive strength of concrete shall be 3000 psi, protect concrete from freezing conditions. Install thrust block from undisturbed soil to mid diameter of the pipes.
2. Manhole and Catch Basin Construction: Use precast concrete base sections. Make inverts in precast concrete bases with a smooth-surfaced semi-circular bottom conforming to the inside contour of the adjacent drainage sections. For precast concrete construction, make joints between sections with the gaskets specified for this purpose; install in the manner specified for installing joints in concrete piping. Give a smooth finish to inside joints of precast concrete manholes and catch basins. Parging will not be required for precast concrete manholes. Make joints between concrete manholes and pipes entering manholes with the resilient connectors specified for this purpose; install in accordance with the recommendations of the connector manufacturer. Where a new manhole is constructed on an existing line, remove existing pipe as required to construct the manhole. Cut existing pipe so that pipe ends are approximately flush with the interior face of manhole wall, but not protruding beyond into the manhole. Use resilient connectors as specified for pipe connectors to concrete manholes.

D. Metal Work

1. Rims, Frames, Grates, and Covers: Set grating frames in a bed of mortar to grades as indicated on the Drawings. Set all units in strict accordance with the manufacturer's written installation instructions. For additional rim and frame raising conditions set frame on precast risers or "doughnuts."
2. Workmanship and Finish: Perform metal work so that workmanship and finish will be equal to the best practice in modern structural shops and foundries. Form iron and steel to shape and

size with sharp lines and angles. Do shearing and punching so that clean true lines and surfaces are produced. Make castings sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Give exposed surfaces a smooth finish with sharp well-defined lines and arises. Provide rabbets, lugs, and brackets wherever necessary for fitting and support.

3. Field Painting: After installation, clean steel covers and steel or concrete frames not buried in masonry or concrete to bare metal of mortar, dirt, grease, and other deleterious materials. Apply a coat of primer, zinc oxide to a minimum dry film thickness of .5-mil; and apply a topcoat, epoxy to a minimum dry film thickness of .5-mils, color optional. Do not paint surfaces subject to abrasion.

E. Trench Drain installation

1. The sub-base must be excavated sufficiently to ensure a minimum of 6" of concrete cover underneath and on both sides of the finished drain system. Slope the edges of the excavation to provide a smooth transition to the slab subgrade. Slope the bottom of the excavation to approximately follow the slope of the channels. The excavation should be made along the center lines of all the proposed drainage runs. Prepare a deeper excavation for all appropriate catch basins to ensure a minimum of 6" of bedding concrete underneath. Once the excavations are complete, place all of the required components (in the correct order) next to the excavation. It is often helpful at this point to set an alignment "string line" over the proposed trench run to indicate the finished grade elevation.
2. The catch basin should be located near the discharge piping stub-in. Carefully drill out the cutouts which correspond to the desired pipe size to be used. Make the appropriate discharge pipe connections. Place the catch basin into the excavation and support it with bricks. Place the bedding concrete into the catch basin and level it to the correct surface elevation. NOTE: Remove the appropriate catch basin channel and end cap cutouts at this time.
3. Begin the installation of the channels at the discharge end of the trench run with the deepest (highest number) channel. If a catch basin is being used at the discharge point, connect this channel to the catch basin (arrows always point downstream). If a catch basin is not being used, attach the proper end cap to the discharge end of the channel. If a channel "bottom cutout" is being used, remove the appropriate size and install the channel over the outlet drain stub-in. The succeeding channels should be installed with the installation chair under the channel at the channel joints being connected. Tighten the chair alignment bolts into channel dimples. Place the pre-cut rebar (minimum 1/2" diameter #4) through rebar connecting clamps. Drive the rebar into the subgrade enough to provide stability and prevent floating during concreting. Adjust the chair, raising the channel to the string line height, and secure the rebar clamps. NOTE: The top of the rebar should be a minimum of 2" below the finished grade. If Extender Panels are to be used, refer to Drawing Details.
4. The proper grate must be secured in the channels prior to concreting to prevent the channels from flexing inward from the pressure of the wet concrete. Grates should be wrapped in plastic prior to installation (2 wraps of 6 mil. visqueen is recommended) to facilitate cleanup after concreting and to provide adequate spacing for grate removal. Care must be taken not to spread the channel walls. NOTE 1: Set the grates (and frames, if applicable) into the channel and install the locking devices. After the placement of the system at the proper grade has been completed, check to ensure that the channels will not "float" when the concrete is placed. When installed properly the installation chair will prevent "floating" by its positive engagement into the sides of the channels. When placing the concrete, be sure it is placed under the channels and is properly consolidated. The concrete that is placed under and around the channels may be placed as part of a monolithic slab pour. NOTE: DO NOT tool finish or radius the edge of the concrete along the drain channels. Finish-trowel only to the top edge of the drain channels.
5. After the concrete slab is hard enough to walk on, remove the wrapping from the grates. Remove the appropriate catch basin channel and end cap cutouts at this time.

3.2 FIELD QUALITY CONTROL

A. Field Tests and Inspections: The Architect/Engineer or representative will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment, and incidentals required for testing, except that the Contractor will furnish water and electric power needed for field tests. Be able to produce evidence, when required, that each item of work has been constructed properly in accordance with the drawings and specifications.

B. Pipeline Testing: Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically full circle of light through the pipeline when viewed from the adjoining end of line.

C. Field Tests for Concrete: Field testing requirements are covered in Section 033000, "Cast-in-Place Concrete"

END OF SECTION 334100

SECTION 334200 – UNDERDRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes Type “B” and Type “C” underdrain systems, including furnishing, excavating, laying, backfilling and finish grading underdrain piping, bedding and backfill materials prior to the placement of granular base and subbase material for use in road foundation soils.

B. Related sections

1. 312000 – Earth Moving for Structures and Pavements
2. 312100 – Earth Moving for Utilities
3. 334100 - Storm Drainage System

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

STATE OF MAINE DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS (MDOT)

As referenced

1.4 SUBMITTALS

A. Manufacturer’s product data

1. Submit manufacturer's product data for each type of drainage pipe required. Show types and sizes of fittings and accessories proposed for this work.

a. All product data.

B. Field Test Reports

1. Submit gradation test for all bedding and backfill material.

PART 2 - PRODUCTS

2.1 UNDERDRAIN PIPE

A. Perforated Underdrain Pipe:

1. (Type B) MDOT 605.03 shall consist of a 6 inch diameter corrugated or smooth walled interior pipe consisting of the following type:

   a. Corrugated polyethylene drainage tubing, slotted for underdrain
   b. Polyvinyl Chloride (PVC) perforated pipe.

2. (Type C) MDOT 605.03 shall consist of a 12 to 30 inch diameter smooth wall interior pipe consisting of the following type:

   a. Corrugated polyethylene drainage tubing, slotted for underdrain
   b. Polyvinyl Chloride (PVC) perforated pipe.

3. Shall meet the requirements of ASTM F758 and AASHTO M252.
4. Acceptable Products/Manufacturers:

   a. Hancor
   b. ADS pipe
   c. Sewer and Drain pipe (S&D) by EJP, Inc.
   d. Perf by Scepter
   e. Or approved similar or equal
   f. Substitutions - In accordance with Section 013300.

2.2 UNDERDRAIN BACKFILL MATERIAL (MDOT 703.22)

A. Granular material for underdrain Type “B” shall be free from organic matter and shall conform to the following table.

Sieve Designation	Percent Finer by Weight
1 inch	95-100
1/2 inch	75-100
No. 4	50-100
No. 20	15-80
No. 50	0-15
No. 200	0-5

B. Crushed or uncrushed material for underdrain type C shall conform to the following table.

Sieve Designation	Percent Finer by Weight
1 inch	100
3/4 inch	90-100
3/8 inch	0-75
No. 4	0-25
No. 10	0-5

C. Angular material for a French drain underdrain shall conform to the following table. (per MDOT 703.24)

Sieve Designation	Percent Finer by Weight
6 inch	100
1-1/2 inch	0-40
No. 4	0-5

2.3 COMPACTED CLAY BEDDING MATERIAL

A. Shall be a dense, poorly graded material free from friables and organic material. Shall be capable of providing an impervious barrier and of supporting the Type “C” underdrain piping and expected loads.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordination installation of the underdrain system with excavating and backfilling work performed under Sections 312000 and 312100.

1. After the road subgrade has been established, excavate the underdrain trench in accordance with sections and locations shown on the drawings.
2. Do not lay damaged or defective pipe.
3. Pipe shall not be laid in water or when the trench conditions or weather is unsuitable for such work. Remove water from trenches by pumping or other approved methods.
4. Lay pipe with the bell ends upstream.

B. Type “B” Underdrain Construction (MDOT 605.04)

1. The trench shall be excavated to the required width and depth and a bed of the specified granular underdrain material, 6 inches in depth, shall be prepared in the trench. Six inch perforated pipe shall be laid and firmly bed with the perforations down as shown on the section drawings. The pipe shall bear on the bedding material along its entire length.
2. After the pipe has been firmly bedded and joints securely connected, it must be inspected by the Architect/Engineer, Town appointed Engineer and the Contracting Officer before any backfill is placed. An additional 6" of granular free-draining French drain material shall be placed over the top of the pipe. The remaining backfill shall be granular fill material meeting the requirements of Section 312100.
3. For underdrain placed under areas of proposed pavement, the backfill material shall be placed in 8 inch layers, loose measure and thoroughly compacted except that the initial layer of backfill around the pipe may be placed in a layer not exceeding 12 inches.
4. For underdrains placed under areas not proposed to be paved, the initial layer of backfill shall not exceed 12 inches and the remaining material may be placed in 1 lift to the elevation of the subgrade and compacted with heavy rubber tired of vibratory compaction equipment to an 85% modified proctor density.
5. The upstream end of all completed underdrain pipe that is to be buried shall be sealed with cement mortar or a plastic end cap or other acceptable material. Temporary end caps shall be used in areas which will be constructed at a later date. Care shall be taken that soil does not enter the pipe. Pipe so contaminated before backfilling shall be removed, cleaned and relaid.

C. Type “C” Underdrain Construction (605.04)

1. The trench shall be excavated to the required width and depth and a bed of the specified granular underdrain material, 6 inches in depth, shall be prepared in the trench. The required perforated pipe shall be laid and firmly bed with the perforations up as shown on the section drawings. The pipe shall bear on the bedding material along its entire length.
2. After the pipe has been firmly bedded and joints securely connected, it must be inspected by the Architect/Engineer, Town appointed Engineer and the Contracting Officer before any backfill is placed. Additional granular free-draining underdrain material shall be rammed below the haunches and placed over the top of the pipe with power pneumatic hand tampers (MDOT 603.08) as shown on the section drawings. Six inches of shaped coarse aggregate underdrain material shall be placed over the top invert of the piping as shown on the section drawings. The remaining backfill shall be granular fill material meeting the requirements of Section 312100.
3. The backfill material shall be placed in 8 inch layers, loose measure and thoroughly compacted with power pneumatic hand tampers or vibratory equipment to 95% modified proctor, except that the initial layer of backfill around the pipe may be placed in a layer not exceeding 12 inches.
4. When construction equipment is used or traffic is maintained the Contractor shall maintain a minimum cover of three feet (3') over all pipes. Whenever this cover extends above the subgrade the Contractor shall temporarily place granular fill which shall be removed when necessary to complete the work in accordance with the plans and specifications.
5. Coupling bands shall be used on all pipe as required by the individual pipe manufacturer.
6. The upstream end of all completed underdrain pipe that is to be buried shall be sealed with cement mortar or a plastic end cap or other acceptable material. Temporary end caps shall be used in areas which will be constructed at a later date. Care shall be taken that soil does not enter the pipe. Pipe so contaminated before backfilling shall be removed, cleaned and relaid.

D. Underdrain Construction in Embankment: When underdrain is to be constructed in embankment fill, the excavation for the trench shall be done after the embankment has been completed to the subgrade elevation unless directed otherwise by the Architect/Engineer.

3.2 TOLERANCES

A. Lay with minimum uniform pitch of 6 inches in 100 feet unless shown otherwise on drawings. Use a laser alignment or similar method to achieve straight, uniform grades.

B. Pipes shall be inspected between manholes by shining a bright light and upon inspection, a uniform circle of light shall appear at the opposite end.

C. In the event that a trench is overexcavated, the grade shall be brought back with compacted granular fill material compacted to 95% modified proctor.

3.3 FIELD QUALITY CONTROL

A. Test system as required by Architect/Engineer. In general, this will require observing the system during a rainfall event. In dry weather conditions, water shall be discharged in an amount as required by the Architect/Engineer who shall observe the systems characteristics.

B. Test material for conformance to specified requirements. General Contractor to arrange for and Owner to pay for all soils and field testing. The General Contractor shall pay for any required retesting by the Architect and Owner.

C. The contractor reserves the right to test the material for proper gradation in advance of the project's notice to proceed, however the owner reserves the right to request the material be retested once the

materials has arrived on site, especially including but not limited to if one of the following has occurred; more than 3 months have passed since the initial material testing had been done, if the material arriving on site for placement appears to not meet spec, if the supplier stockpile has been reworked or if the stockpile supplier has changed, or if mixing of on-site stockpiles has occurred, or other similar occurrences which may affect the products integrity. The contractor incurs the cost of this additional testing.

D. Additional field quality control testing as specified in section 312100.

3.4 ENVIRONMENTAL PROTECTION

A. When working adjacent to a protected resource or other sensitive area, or in areas where erosion and sediment could enter the system, protect as shown on the drawings with temporary inlet devices and as specified in Section 313000.

END OF SECTION 334200

REPORT

July 12, 2012
12-0034 S

Geotechnical Engineering Services

Proposed Additions and Renovations
Cumberland County Civic Center
Free Street, Center Street and Spring Street
Portland, Maine

PREPARED FOR:
Cumberland County Recreation Center
d/b/a Cumberland County Civic Center
Attn: Joe Bruno
One Civic Center
Portland, Maine 04101

PREPARED BY:
S.W.COLE ENGINEERING, INC.
286 Portland Road
Gray, Maine 04039
207-657-2866

S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing*
- *GeoEnvironmental Services*
- *Ecological Services*

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TABLE OF CONTENTS

12-0034 S

July 12, 2012

Cumberland County Recreation Center
d/b/a Cumberland County Civic Center
Attn: Joe Bruno
One Civic Center
Portland, Maine 04101

Subject: Geotechnical Engineering Services
Proposed Additions and Renovations
Cumberland County Civic Center
Free Street, Center Street and Spring Street
Portland, Maine

Dear Joe:

In accordance with our Proposal dated March 30, 2012, we have performed subsurface explorations for the proposed additions and renovations to the Cumberland County Civic Center (CCCC) in Portland, Maine. This report presents our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our work was to obtain subsurface information at the site of the proposed additions in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of work included review of prior exploration data, the making of eight test borings, soils laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Proposed Construction

We understand proposed renovations and additions to the CCCC include in-fill additions to the northwest and southwest entries, extension of the southeast entry and reconfiguration of the loading dock. Specifically, we understand:

- Northwest Entry: the existing plaza will be reconfigured and enclosed to add restrooms at the concourse level.

- Loading Docks: the existing loading dock will be skewed and reconfigured to 4 bays. The new configuration will take some of the footprint of the existing northeast arena level and southeast mechanical level.

- Southeast Entry: the existing exterior stairs and plaza will be demolished and the building extended to the corner of Spring and Center Streets to create a new enclosed street level entry about 4 feet above the mechanical level and new restrooms and concession space on the course level.

- Southwest Entry: the existing plaza will be reconfigured and in-filled to improve concourse level circulation and create new club and locker room space.

Existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Eight test borings (B-101 through B-108) were made at the site in June 2012. The test borings were made by Great Works Test Boring, Inc. of Rollinsford, New Hampshire working under subcontract to S.W.COLE ENGINEERING, INC. These exploration locations were selected and established in the field by S.W.COLE ENGINEERING, INC. based upon measurements from existing site features and utility constraints. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. The approximate locations of fifteen prior test borings (B-1 through B-15) made in October 1973 are also shown on Sheet 1 based upon historical survey information in the facilities records.

Logs of the explorations are attached as Sheets 2 through 9. A log of rock cores obtained at B-103 and B-107 is attached as Sheet 10. The ground surface elevations shown on the logs were estimated based on topographic information shown on Sheet 1. Logs of the prior explorations made in October 1973 for the original design of the facility are shown on Sheet 1. A log of October 1973 rock cores viewed at the facility in June 2012 is attached as Sheet 11. A key to the notes and symbols used on the logs is attached as Sheet 12.

2.2 Testing

The test borings were made using solid-stem auger drilling techniques. The soils were sampled at 2 to 5-foot intervals using a split spoon sampler and Standard Penetration Test (SPT) methods at the test borings. SPT blow counts are shown on the logs. Soil samples obtained from the test borings were returned to our laboratory for classification. The site soils are not considered reactive, corrosive nor expansive.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site is located on the Portland peninsula bounded by Free, Center and Spring Streets. Based on facility records, we understand:

- The existing building was built on a relatively flat site that sloped gently downward from a high elevation of about 89 feet (project datum) in the northwest corner along Free Street to a low elevation of about 54 feet in the southeast corner near the corner of Spring and Center Streets.

- The facility was cut into the site with finished floor elevations of 76.0 feet for the Concourse Level, 67.3 feet for the Arena Level and 64.3 feet for the Skating Lobby. The southeast portion of the Skating Lobby floor slabs are anticipated to be on compacted fill. A Mechanical Level basement was constructed in the southeast corner of the site with the lowest level finished floor elevation of 50.8 feet.

- The original design documents specified that all footings bear on relatively shallow bedrock present beneath the site and that the foundation bearing surfaces be inspected by a licensed P.E. prior to casting foundation concrete.
- Excavation and blasting records to remove bedrock are not available.

Existing site conditions and approximate topography around the site boundary are shown on the "Exploration Location Plan" attached as Sheet 1.

3.2 Subsurface Conditions

The subsurface conditions encountered in the test borings at each of the proposed addition or renovation areas are summarized below. Refer to the attached logs for more detailed descriptions of the subsurface findings at the exploration locations.

Northwest Entry (B-101 and B-102): These test borings encountered a surficial layer of mulch over fill to depths of ½ to 4 feet before encountering refusal surfaces interpreted to be bedrock (B-102) and a relic slab (B-101).

Free water was not encountered in these test borings; however groundwater likely becomes perched on the shallow refusal surfaces.

Loading Dock (B-103): This test boring encountered a surficial layer of asphalt overlying sand and gravel fill to a depth of 11 feet before encountering bedrock where a 5-foot rock core was taken to a depth of 16.3 feet. It should be noted this boring was completed on the existing truck ramp that slopes steeply upward from Center Street (approximate elevation 60 feet) to the Arena Level of the building (approximate elevation 67.3 feet), thus the thickness of fill is anticipated to increase with elevation gain.

Free water was not encountered in these test borings; however groundwater likely becomes perched on the shallow refusal surfaces.

Southeast Entry (B-104 and B-105): Below a concrete sidewalk, B-104 encountered silty sand fill to a depth of about 3 feet overlying native glacial till to a depth of about 10 feet overlying a refusal surface interpreted to be bedrock. Below a concrete sidewalk, boring B-105 encountered sand and gravel fill to a depth of about 10 feet overlying a thin veneer of glacial till before encountering a refusal surface interpreted to be bedrock at a depth of

about 10.5 feet. The fill encountered in B-105 is interpreted to be backfill for the existing mechanical level basement.

Groundwater was observed at depths of 6 to 6.5 feet in these test borings, which approximately corresponds to the basement floor elevation.

Southwest Entry (B-106, B-107 and B-108): Below a layer of topsoil, B-106 encountered sand and gravel fill to a depth of 4.5 feet overlying glacial till mantling bedrock at a depth of about 12 feet. Boring B-107 was made in the southwest plaza and encountered concrete pavement overlying sandy fill to a depth of about 7 feet overlying bedrock where a 5-foot core was taken to a depth of 12.1 feet. Boring B-108 was made along the sidewalk of the southwest entry and encountered fill mantling a refusal surface, interpreted to be bedrock, at a depth of about 3 feet.

Free water was not encountered in these test borings; however groundwater likely becomes perched on the shallow refusal surfaces.

3.3 Seismic and Frost Considerations

The 25-year Air Freezing Index for the Portland, Maine area is about 1,250-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. Based on the findings at the test borings and existing and new foundations being founded on bedrock, we interpret the site soils to correspond to Seismic Site Class B according to 2009 IBC N-value method.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations are:

- Spread footing foundations and on-grade floor slabs bearing on properly prepared subgrades are appropriate for the proposed construction. All footings must be excavated and founded on sound, intact bedrock. On-grade floor slabs may be founded on a layer of new base gravel overlying bedrock, native glacial till or densified existing sandy fills.

- Perimeter foundation underdrains should be provided for the proposed building additions.

- The native soils are unsuitable for reuse as backfill for proposed building foundations. The existing sand and gravel fills may be suitable for reuse as Granular Borrow in building areas not exposed to freezing. Imported Structural Fill, Crushed Stone and Crushed Gravel will be needed for construction.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits.

Fill and Slab Areas: Organics and existing pavements, sidewalks must be completely removed beneath the proposed building addition footprints and fill areas. Following removal of surface cover, the existing fills should be densified and compacted prior to placing new fills. Areas that become soft or yield after densification, should be removed and replaced with compacted Structural Fill.

Footing Subgrades: All footings should be excavated to and founded on sound, intact bedrock. Bedrock surfaces should be cleaned of loose debris prior to casting foundations. Bearing surfaces must be observed by the Geotechnical Engineer of Record prior to casting foundations.

4.3 Excavation and Dewatering

Excavation work will generally encounter topsoil, existing pavements and sidewalk, sandy fills, native glacial till and bedrock. Care must be exercised during construction to minimize disturbance of the sensitive slab and pavement bearing soils. Final cuts to subgrade in native glacial till for slabs and pavement should be performed with a smooth-edged bucket to help minimize soil disturbance. Bedrock removal will require blasting or hoe-ramming. If blasting is employed, care must be taken not to overblast below foundation bearing surfaces.

Sumping and pumping dewatering techniques should be adequate to control groundwater in excavations. A layer of Crushed Stone may be added over the bottom of excavations to

provide a drainage media from which to sump and pump. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction.

Excavations must be properly shored and/or sloped according to OSHA Regulations to prevent sloughing and caving of the sidewalls during construction.

4.4 Foundations

We recommend the proposed building be supported on spread footing foundations bearing on sound intact bedrock. We recommend the following geotechnical parameters for design consideration:

- Design Frost Depth = 4.5 feet (2.5 feet if on bedrock)
- Net Allowable Soil Bearing Pressure = 25 ksf or less (sound, intact bedrock)
- Base Friction Factor = 0.7 (Concrete to Bedrock)
- Passive Lateral Earth Pressure Coefficient = 3.0
- At-Rest Lateral Earth Pressure Coefficient = 0.5
- Total Unit Weight of Backfill = 130 pcf (Structural Fill)
- Internal Friction Angle of Backfill = 30 degrees
- Seismic Soil Site Class = B (2009 IBC, N-value method)

Post-construction settlement is anticipated to be less than ¼ inch between foundations founded on bedrock.

4.5 Foundation Drainage

We recommend an underdrain system be installed near footing grade around the perimeter footings. The underdrain pipe should consist of 4-inch diameter, perforated SDR-35 foundation drain pipe enveloped in 12-inches of Crushed Stone wrapped in filter fabric, such as Mirafi 160N. The underdrain pipe must be connected to a positive gravity outlet protected from freezing, clogging and backflow.

Exterior foundation backfill should be sealed with a surficial layer of clayey or loamy soil in areas that are not paved or occupied by entrance slabs. This is to reduce direct surface water infiltration into the backfill. Surface grades should be sloped away from the building for positive surface water drainage. General underdrain details are shown on Sheet 13.

4.6 Slab-On-Grade Floors

We recommend on-grade concrete floors be supported on a minimum of 12 inches of compacted Structural Fill. On-grade floor slabs founded on properly prepared subgrades may be designed considering a modulus of subgrade reaction of 170 pci. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material shall be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.7 Entrance Slabs and Sidewalks

Entrance slabs and sidewalks adjacent to buildings must be designed to reduce the effects of differential frost action between adjacent pavement, doorways, and entrances. We recommend that clean, non-frost susceptible sand and gravel meeting the requirements of Structural Fill be provided to a depth of at least 4.5 feet below the top of entrance slabs. This thickness of Structural Fill should extend the full width of the entrance slabs and outward at least 4.5 feet, thereafter transitioning up to the bottom of the adjacent sidewalk or pavement subbase gravel at a 3H:1V or flatter slope. General details of this frost transition zone are attached as Sheet 13.

Entrance slabs serving as pavements, such as loading docks, may designed using a modulus of subgrade reaction of 170 pci provided they are underlain by at least 12 inches of Structural Fill with a frost transition zone as discussed above.

4.8 Backfill and Compaction

Based on the subsurface findings, the native glacial till soils are unsuitable for reuse as fill within the building. Existing sandy fills may be reused as Granular Borrow within areas not exposed to freezing. We recommend the following fill and backfill materials.

Granular Borrow: Compacted fill to raise site grades in building and paved areas should be sand, silty sand or sand and gravel meeting the requirements of MDOT Standard Specification 703.19 "Granular Borrow" as given below.

MDOT 703.19 Granular Borrow	
Sieve Size	**Percent Finer by Weight**
6 inch	100
#40	0 to 70
200	0 to 10

Structural Fill: Fill to raise site grades over wet subgrades, backfill for foundations and base gravel below floor slabs should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below.

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
#40	0 to 30
#200	0 to 5

Crushed Stone: Crushed Stone, used as foundation drainage and underdrain aggregate, should meet the gradation requirements of MDOT Standard Specifications 703.22 "Underdrain Backfill Type C".

MDOT 703.22 Underdrain Backfill Type C – Crushed Stone	
Sieve Size	**Percent Finer by Weight**
1 inch	100
¾ inch	90-100
⅜ inch	0-75
#4	0-25
#10	0-5

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted in loose lifts not exceeding 12 inches.

4.9 Weather Considerations

The native glacial till soils are easily disturbed especially when wet. Earthwork and foundation construction activities should be limited during wet and freezing weather. The contractor should anticipate the need to moisture condition fills in order to facilitate compaction. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.10 Design Review and Construction Testing

S.W.COLE ENGINEERING, INC. should be retained to review the final design and specifications to determine that our earthwork and foundation recommendations have been properly interpreted and implemented.

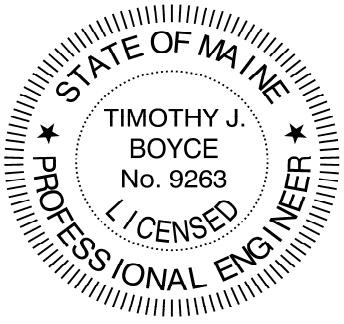
A soils and concrete testing program should also be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE ENGINEERING, INC. is available to provide subgrade observations for foundations as well as testing services for soils, concrete, asphalt, steel and spray-applied fireproofing construction materials.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S.W.COLE ENGINEERING, INC.



Timothy J. Boyce, P.E.
Senior Geotechnical Engineer

TJB:rec

Attachment A
Limitations

This report has been prepared for the exclusive use of Cumberland County Recreation Center for specific application to the proposed Cumberland Country Civic Center Renovations and Additions in Portland, Maine. S.W.COLE ENGINEERING, INC. has endeavored to conduct the work in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

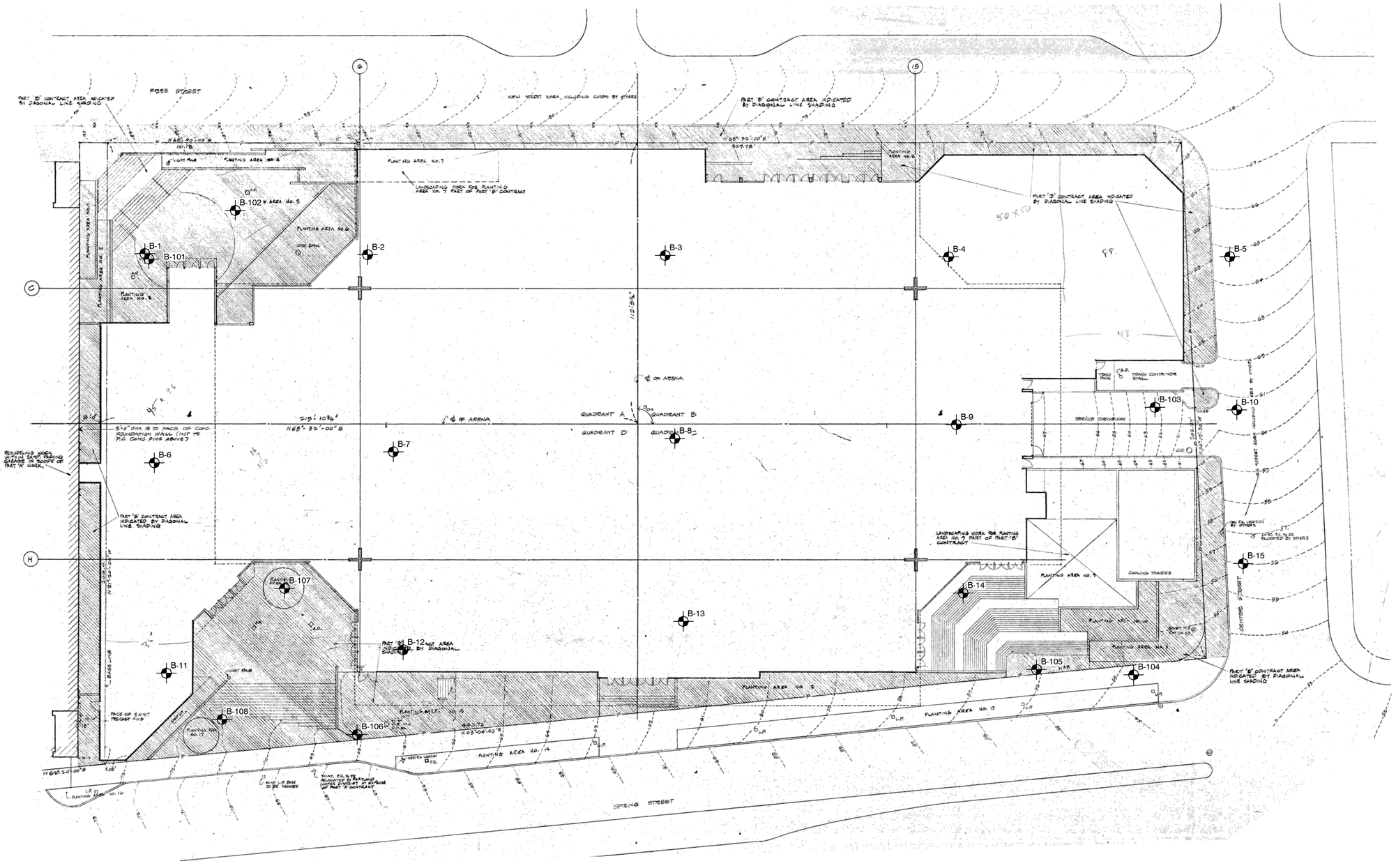
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE ENGINEERING, INC.'s scope of work has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE ENGINEERING, INC. should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE ENGINEERING, INC.



BORING DATA · FOR INFORMATION ONLY

BORINGS PERFORMED BY D.L.JONES . OCTOBER, 1973 — ROCK RECOVERY BASED ON 1⅛" BARREL 5' DEPTH OF CORE — FULL REPORT AVAILABLE IN ARCHITECT'S OFFICE

B-1 El. 82.4'	B-2 El. 78.5'	B-3 El. 73.0'	B-4 El. 66.5'	B-5 El. 61.2'	B-6 El. 77.6'	B-7 El. 72.9'	B-8 El. 69.9'	B-9 El. 62.2'	B-10 El. 57.7'	B-11 El. 71.2'	B-12 El. 66.8'	B-13 El. 60.0'	B-14 El. 65.9'	B-15 El. 53.4'
3'-0" SAND & GRAVEL; ROCK 100% RECOVERY	2'-0" REFUSAL	FILL; BOULDERS; 7'-0" SAND & GRAVEL; ROCK 80% RECOVERY	SAND & GRAVEL; 12'-0" REFUSAL	SAND & GRAVEL; 10'-0" ROCK 100% RECOVERY	SAND & GRAVEL; 5'-0" REFUSAL	SAND & GRAVEL; 3'-6" CLAY & BOULDERS; ROCK 85% RECOVERY	SAND & GRAVEL; SILTY SAND & GRAVEL; 13'-6" REFUSAL	FILL; BASEMENT FILL; 11'-0" SAND & GRAVEL; ROCK 70% RECOVERY	SILTY SAND & GRAVEL; SAND, GRAVEL & WEATHERED ROCK; 9.2'± REFUSAL	FILL; SAND & GRAVEL; 5'-0" ROCK 90% RECOVERY	SILTY SAND; 8'-6" REFUSAL	FILL; SAND & GRAVEL; 11'-0" ROCK 85% RECOVERY	FILL; SILTY SAND & GRAVEL; 7'-6" REFUSAL	SAND & GRAVEL; 15'-0" ROCK 90% RECOVERY

LEGEND:

⊕ APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1/16" = 1'-0' SCALE PLAN OF THE SITE ENTITLED "SITE PLAN," PREPARED BY EDUARDO CATALANO, ARCHITECT, DATED SEPTEMBER 18, 1974 AND PROVIDED AS A PORTABLE DOCUMENT FORMAT (PDF)
2. BORINGS B-1 THROUGH B-15 WERE PERFORMED BY D.L. JONES, OCTOBER 1973 AND PROVIDED ON THIS PLAN BASED ON LOCATIONS SHOWN ON A 1/16" = 1'-0" PLAN OF THE SITE ENTITLED "SURVEY PLAN," PREPARED BY EDUARDO CATALANO, ARCHITECT AND PROVIDED AS A PORTABLE DOCUMENT FORMAT (PDF).
3. BORINGS B-101 THROUGH B-108 WERE PERFORMED BY S.W. COLE ENGINEERING, INC., JUNE 2012 AND WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
4. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S.W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
5. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

NO.	DATE	DESCRIPTION	BY
2	07/12/2012	FINAL REPORT SUBMISSION	CEM
1	06/21/2012	REPORT SUBMISSION	CEM
-	06/14/2012	DRAFT SUBMISSION	CEM

0 10 20 40 60 80

SCALE IN FEET

S.W.COLE ENGINEERING, INC.

CUMBERLAND COUNTY RECREATION CENTER

EXPLORATION LOCATION PLAN

PROPOSED ADDITIONS AND RENOVATIONS
CUMBERLAND COUNTY CIVIC CENTER
FREE STREET, CENTER STREET AND SPRING STREET
PORTLAND, MAINE

Job No.: 12-0034 Scale: 1" =20'±
Date : 06/14/2012 Sheet: 1

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-101**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : S.W. COLE ENGINEERING. INC. DRILLER:

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 76' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	6"	POWER HEAD	
SAMPLER:				
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST AT 0.3'±

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.2'	TOPSOIL / MULCH
									0.5'	BROWN SILTY GRAVELLY SAND WITH BRICK (FILL)
										REFUSAL AT 0.5' (CONCRETE SLAB)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:

	DRILLER - VISUALLY
X	SOIL TECH. - VISUALLY
	LABORATORY TEST

REMARKS:

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-101**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-102**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : S.W. COLE ENGINEERING, INC. DRILLER:

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 76' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	6"	POWER HEAD	
SAMPLER:				
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST AT 0.3'±

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.3'	TOPSOIL / MULCH
									4.0'	BROWN GRAVELLY SAND SOME SILT (FILL)
										REFUSAL AT 4.0' (PROBABLE BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:

	DRILLER - VISUALLY
X	SOIL TECH. - VISUALLY
	LABORATORY TEST

REMARKS:

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-102**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-103**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 62' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	4 1/2"		
SAMPLER:	SS	2"	140 lbs	30"
CORE BARREL:	NQ2	2"		

WATER LEVEL INFORMATION
SOILS MOIST AT 5.0'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW									0.4'	ASPHALT
	1D	24"	18"	2.5'	9	9	8	8		BROWN SAND AND GRAVEL SOME SILT (FILL)
	2D	24"	14"	4.5'	7	9	15	17		~MEDIUM DENSE BECOMING…
	3D	24"	18"	7.0'	10	21	28	40		...VERY DENSE~
	4D	6"	6"	7.5'	50					
	5D	14"	13"	11.2'	9	21	50/2"		11.0'	RQD = 76% BEDROCK-SEE ROCK CORE LOG
	6D	5.0'	4.9'	16.3'					16.3'	BOTTOM OF EXPLORATION AT 16.3'

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-103**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-104**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 55' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	4 1/2"		
SAMPLER:	SS	2"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER AT 6.0' IN OPEN BORE HOLE

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.4'	CONCRETE SIDEWALK
										BROWN SILTY SAND (FILL)
	1D	24"	18"	3.0'	4	5	6	5	3.0'	~MEDIUM DENSE~
	2D	24"	20"	5.0'	6	10	14	14		MOTTLED RUST BROWN SILTY GRAVELLY SAND (GLACIAL TILL)
	3D	24"	24"	7.0'	7	9	19	23	7.0'	~MEDIUM DENSE~ (POSSIBLY RE-WORKED)
	4D	24"	24"	9.0'	20	10	10	10		LIGHT GRAY GRAVELLY SILTY SAND (GLACIAL TILL) ~MEDIUM DENSE~
	5D	24"	12"	11.0'	18	50			10.1'	
										WEATHERED BEDOCK
									12.5'	
										REFUSAL AT 12.5' (BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-104**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-105**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 56' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	4 1/2"		
SAMPLER:	SS	2"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
FREE WATER AT 6.5' IN OPEN BORE HOLE

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.5'	CONCRETE SIDEWALK
	1D	24"	15"	3.0'	8	11	20	22		BROWN SILTY SAND AND GRAVEL (FILL)
	2D	24"	18"	5.0'	25	34	30	25		~VERY DENSE~
	3D	24"	18"	7.0'	11	24	33	27		
	4D	24"	17"	9.0'	21	23	13	12	10.0'	
	5D	6"	3"	10.5'	3	50/0"			10.5'	BROWN SILTY GRAVELLY SAND (GLACIAL TILL) ~LOOSE~
									11.5'	BEDROCK
										REFUSAL AT 11.5' (BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:

	DRILLER - VISUALLY
X	SOIL TECH. - VISUALLY
	LABORATORY TEST

REMARKS:

STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-105**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-106**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 68' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	4 1/2"		
SAMPLER:	SS	2"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS SATURATED AT 3.0'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									0.5'	BLACK/BROWN SAND AND SILT WITH ORGANICS (TOPSOIL)
	1D	24"	18"	2.0'	7	15	12	11		BROWN SILTY SAND AND GRAVEL (FILL) ~MEDIUM DENSE~
	2D	24"	18"	4.0'	11	16	12	12	4.5'	
	3D	24"	18"	7.0'	10	24	21	15		MOTTLED RUST BROWN GRAVELLY SILTY SAND WITH WEATHERED BEDROCK FRAGMENTS (GLACIAL TILL) ~VERY DENSE~ (POSSIBLY RE-WORKED)
	4D	24"	20"	9.0'	29	30	30	27	9.5'	
	5D	21"	17"	11.8'	9	5	7	50/3"	11.8'	LIGHT GRAY SILTY SAND SOME GRAVEL (GLACIAL TILL) ~MEDIUM DENSE~
									12.2'	BEDROCK
										REFUSAL AT 12.2' (BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-106**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-107**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 76' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	4 1/2"		
SAMPLER:	SS	2"	140 lbs	30"
CORE BARREL:	NQ2	2"		

WATER LEVEL INFORMATION
SOILS MOIST AT 4.5'

CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
HW									0.4'	CONCRETE SIDEWALK
	1D	24"	10"	2.5'	2	2	1	1		BROWN SAND AND SILT WITH ORGANICS (FILL) ~LOOSE~
	2D	24"	18"	4.5'	2	2	2	5	4.4'	
	3D	24"	12"	7.0'	7	11	9	7	7.0'	BROWN GRAVELLY SILTY SAND (FILL) ~MEDIUM DENSE~
	4D	1"	0"	7.1'	25/1"					RQD = 61% BEDROCK-SEE ROCK CORE LOG
	R1	5.0'	4.6'	12.1'					12.1'	
										BOTTOM OF EXPLORATION AT 12.1'

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-107**

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: **B-108**
SHEET: 1 OF 1
PROJECT NO.: 12-0034

PROJECT / CLIENT: CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS
LOCATION: SPRING, CENTER & FREE STREETS, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORINGS, INC. DRILLER: JEFF LEE

DATE START: 6/6/2012
DATE FINISH: 6/6/2012
ELEVATION: 71' ±
SWC REP.: PJO

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	SSA	4 1/2"		
SAMPLER:	SS	2"	140 lbs	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST AT 1.0'

CASING BLOWS PER FOOT	SAMPLE NO.	SAMPLE PEN.	SAMPLE REC.	SAMPLE DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
									1.0'	BLACK/BROWN SAND AND SILT WITH ORGANICS, BRICK (FILL) ~LOOSE~
	1D	24"	16"	2.0'	4	5	10	10		BROWN SAND AND GRAVEL SOME SILT (FILL)
	2D	11"	5"	2.9'	10	50/4"			2.9'	~MEDIUM DENSE~
									3.5'	BEDROCK
										REFUSAL AT 3.5' (BEDROCK)

SAMPLES:
D = SPLIT SPOON
C = 2" SHELBY TUBE
S = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: **B-108**

S.W.COLE ENGINEERING, INC.

CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS

CORE BOX SUMMARY SHEET 1 OF 2

BORING(S) NO: B-107 AND B-103

PROJECT NO & LOCATION: 12-0034 / PORTLAND, ME

LOGGED BY PJO **DATE:** 6/7/2012

CHECKED BY GWB **DATE:** 6/7/2012

PHOTO: B-107 R1 (7.1'-12.1'), B-103 (11.3'-16.3')

BORING	RUN NO.	CORE SIZE	DEPTH & CORE INTERVAL (FT)	RECOVERY (FT)	RQD (%)	ROCK QUALITY	LITHOLOGIC DESCRIPTION
B-107	R1	NQ2	7.1-12.1 (5.0)	4.6'	61	Fair	Gray Schist (Spring Point Formation); moderately hard; fine grained; slightly weathered, quartz veins pitted and iron oxide stained; closely spaced shallow to steeply dipping fractures at 15-75º from horizontal.
B-103	R1	NQ2	11.3-16.3 (5.0)	4.9'	76	Good	Gray Schist (Spring Point Formation) contains quartz veins and weathered garnets; moderately hard; fine grained; slightly weathered; weakly foliated, closely spaced moderate to steeply dipping fractures at 15-60º from horizontal.

S.W.COLE ENGINEERING, INC.

CUMBERLAND COUNTY CIVIC CENTER RENOVATIONS

CORE BOX SUMMARY SHEET 2 OF 2

BORING(S) NO: B-1, B-11, B-3 & B-13

PROJECT NO & LOCATION: 12-0034 / PORTLAND, ME

LOGGED BY PJO **DATE:** 6/7/2012

CHECKED BY GWB **DATE:** 6/7/2012

PHOTO: B-1 (3'-8'), B-11 (5.8'-10.8'), B-3 (1.5'-5'), B-3 (7'-12'), B-13 (11'-16')

BORING	RUN NO.	CORE SIZE	DEPTH & CORE INTERVAL (FT)	RECOVERY (FT)	RQD (%)	ROCK QUALITY	LITHOLOGIC DESCRIPTION
B-1	R1	AQ	3'-8' (5.0)	3.8'	38%	Poor	Gray Schist (Spring Point Formation); moderately hard; fine grained, weakly foliated; slightly weathered, fracture surfaces stained with iron oxide; closely spaced shallow to steeply dipping mechanical and natural fractures at 15-85º from horizontal.
B-11	R1	AQ	5.8'-10.8' (5.0)	4.0'	70%	Fair	Gray Schist (Spring Point Formation); moderately hard; fine grained; very slightly weathered, fracture surfaces stained with iron oxide; closely spaced shallow to moderately dipping fractures at 15-50º from horizontal.
B-3	R1	AQ	1.5'-5.0' (3.5)	1.5'	0%	Very Poor	Cored a boulder
B-3	R1	AQ	7'-12' (5.0)	3.2'	0%	Very Poor	Gray Schist (Spring Point Formation); moderately hard; fine grained; slightly weathered, highly fractured, surfaces stained with iron oxide. Quartz veins pitted and iron oxide stained.
B-13	R1	AQ	11'-16' (5.0)	4.5'	25%	Very Poor / Poor	Gray Schist (Spring Point Formation); moderately hard; fine grained, weakly foliated; slightly weathered, highly fractured, surfaces stained with iron oxide. Shallow to steep fracture angles and quartz veins.

KEY TO THE NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - based on laboratory unconfined compressive test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. based on pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass. RQD is computed from recovered core samples.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

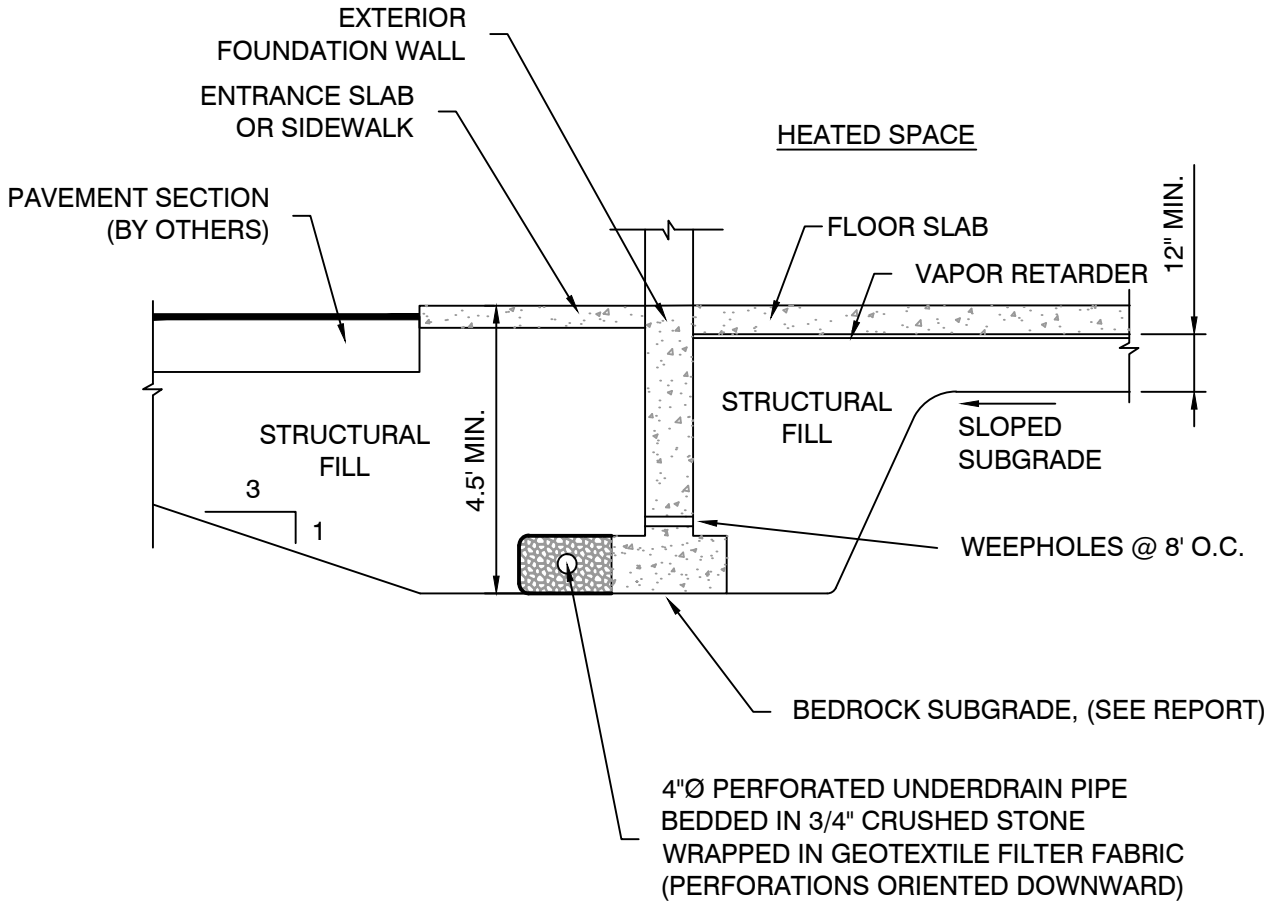
Description of Proportions:

0 to 5% TRACE
5 to 12% SOME
12 to 35% "Y"
35+% AND

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.



NOTE:

1. UNDERDRAIN INSTALLATION AND MATERIAL GRADATION RECOMMENDATIONS ARE CONTAINED WITHIN THIS REPORT.

2. DETAIL IS PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY, NOT FOR CONSTRUCTION.

S.W.COLE ENGINEERING, INC.

CUMBERLAND COUNTY RECREATION CENTER

UNDERDRAIN DETAIL

PROPOSED ADDITIONS AND RENOVATIONS
CUMBERLAND COUNTY CIVIC CENTER
FREE STREET, CENTER STREET AND SPRING STREET
PORTLAND, MAINE

Job No.:	12-0034	Scale:	Not to Scale
Date :	07/12/2012	Sheet:	13

HAZARDOUS MATERIALS IDENTIFICATION REPORT

CUMBERLAND COUNTY CIVIC CENTER
ONE CIVIC CENTER SQUARE
PORTLAND, MAINE

Prepared for:

Cumberland County Recreation Center
One Civic Center Square
Portland, Maine 04101

Prepared by:

Summit Environmental Consultants, Inc.
8 Harlow Street, Suite 4A
Bangor, ME 04401

Project Number: 12-3051

April 10, 2012

TABLE OF CONTENTS

FIGURE

TABLES

APPENDICES

EXECUTIVE SUMMARY

Summit Environmental Consultants, Inc., (Summit) conducted a Hazardous Materials Identification Survey (HMIS) of the Cumberland County Civic Center (CCCC) located at One Civic Center Square in Portland, Maine. The subject property is utilized as a recreation center and is currently scheduled for renovation. The CCCC is a 99,400-square foot, steel and masonry structure with rubber roofing. The building consists of a stadium and associated infrastructure including administrative offices, ticket sales, vendor areas, restaurant, restrooms, locker rooms, storage areas and maintenance areas. The investigation focused on identifying Asbestos-Containing Materials (ACM), Lead-Based Paint (LBP) and hazardous materials present on the interior and exterior of the building that would require special handling and disposal or would be regulated prior to/during renovation of the facility. Inspection of the CCCC was conducted on March 15, 2012.

The investigation revealed the following relevant information:

1. Eighty-three (83) bulk samples of suspect ACM were collected for asbestos analysis from interior and exterior building materials.

   Identified ACM included

   - Floor tile with non-ACM adhesive present in the sound booths and press boxes;
   - Floor tile and associated ACM adhesive present along the east end of the ice rink;
   - Floor tile and associated ACM adhesive present in the entry hall outside the restaurant kitchen: and

   Large diameter cementitious transite conduit used as utility conduit in the ticket booth and in the mechanical tunnel on the northern side of the arena. It appears that the transite conduit was used to house ventilation ducts running under the concrete floor within the building. This could not be confirmed, however it should be assumed that the transite conduit is present under the floor.

2. Potential Universal Wastes including fluorescent lights and light ballasts were identified during the survey. Those ballasts not labeled as "no-PCB" should be segregated and handled as hazardous waste. Additional materials (sodium vapor lamps and mercury thermostats) requiring special handling were identified.

   A LBP determination was conducted using a portable X-Ray Fluorescence (XRF) Lead Paint Analyzer to determine the presence of LBP on identified painted interior and exterior surfaces. LBP was identified on surfaces throughout the interior

3. Ten bulk samples of the window/door caulking were collected from the interior and exterior of the building and analyzed for the presence of Polychlorinated Biphenyl (PCB). Laboratory analytical results were "non-detect" for the caulking samples.

4. An unregistered underground storage tank (UST) is located within a HVAC impoundment on the eastern end of the building below cooling equipment. The UST is reportedly is a 500-gallon diesel fuel tank installed between 1975 and 1976 and is associated with the facility's emergency generator. The UST has reportedly not been

serviced or refilled after the initial filling (1975-76). The condition of the UST and surrounding soils is unknown.

5. Electrical transformers are present beneath the stadium seating. Electrical transformers may contain PCB oil, which if present must be handled as hazardous waste.

Based on Summit's survey/assessment of the property; ACM, LBP and hazardous materials are present at the CCCC. Should these materials be impacted by planned renovations, Summit recommends, at a minimum, removal of those impacted ACM and hazardous materials prior to commencement of renovation activities, as required by applicable State of Maine and federal rules and regulations. The unregistered UST located on the eastern end of the building must be registered with the MEDEP, additionally a notice of intent to remove or abandon the UST should be filed with the registration forms to comply with current UST regulations.

1.0 INTRODUCTION

Summit Environmental Consultants, Inc., (Summit) conducted a Hazardous Materials Identification Survey (HMIS) of the Cumberland County Civic Center (CCCC) located at One Civic Center Square in Portland, Maine. The subject property is utilized as a recreation center and is currently scheduled for renovation. The CCCC is a 99,400-square foot, steel and masonry structure with rubber roofing. The building consists of a stadium and associated infrastructure including administrative offices, ticket sales, vendor areas, locker rooms, storage areas, restaurant, restrooms and maintenance areas. The investigation focused on identifying Asbestos-Containing Materials (ACM), Lead-Based Paint (LBP) and hazardous materials present on the interior and exterior of the building.

2.0 ASBESTOS SURVEY

This Asbestos Identification Survey was conducted in accordance with the Maine Department of Environmental Protection (MEDEP) Chapter 425 Asbestos Management Regulations (April 3, 2011 revision) and was completed to provide Cumberland County Recreation Center (CCRC) with information regarding the presence of interior and exterior ACM associated with the building. Mr. Dennis Kingman and Mr. Brett Deyling (both of Summit), asbestos inspectors licensed in the State of Maine, performed the field survey on March 15, 2012. Copies of the Summit investigator's Asbestos Inspector certifications are included in Appendix B.

Completion of the Asbestos Identification Survey included:

- Visual identification of suspect ACM on the interior and exterior of the building;
- Collection of Eighty Three (83) bulk samples of suspect ACM from the interior and exterior of the building in accordance with MEDEP regulations; and
- Quantification of ACM identified by laboratory analysis.

As with any scientific study, an asbestos identification survey is subject to a variety of limitations. Limitations to be considered in interpreting the results of the survey performed on this building include the following:

- Variations in building materials used during construction and subsequent renovations.
- Inaccessible areas within walls and floors.
- Areas not accessible at the time of the site inspection including:
    - The portion of the mechanical tunnel beneath the stadium seating on the southeast quarter of the stadium; and
    - The kitchen associated with the restaurant on the southwestern portion of the building.
- Roofing systems associated with the structure are rubber membrane type roofs and were identified as having been recently installed. As directed by the client, the rubber membrane roofs were not sampled.

Bulk samples of suspect ACM collected during the survey were submitted to EMSL Analytical, Inc. (EMSL) of Cinnaminson, New Jersey for analysis. Bulk samples collected during this survey were analyzed using the MEDEP required analytical methods: "PLM-EPA 600/R-93/116" (for surfacing, thermal system insulation and cementitious materials) and "PLM NOB-EPA 600/R-93/116" (for non-friable organically bound materials (NOBs)) (i.e.; floor tile, adhesives, and roofing) with "gravimetric reduction". Samples were analyzed at the EMSL laboratory, which is certified to perform asbestos analysis by both the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Industrial Hygiene Association (AIHA). EMSL is a MEDEP licensed Asbestos Analytical Laboratory (A copy of EMSL's laboratory certifications is included in Appendix C). Laboratory analytical results and chain of custodies are included as Appendix A.

During the inspection, Eighty-three (83) bulk samples were collected from suspect ACM including:

- Eight types of mudded insulation on pipe fittings;
- Six types of floor tile and associated mastic;
- Two types of window caulking;
- Acoustic wall covering;
- Generator exhaust insulation;
- Boiler room tank insulation;
- Boiler refractory cement and rope sectional gasketing;
- Sheetrock wall board; and
- Seven types of ceiling tile.

Large diameter, cementitious transite conduit present in the mechanical tunnels and ticket office were not sampled and assumed to be ACM.

The number of samples collected was determined by the number of homogeneous sampling areas identified by the inspector. A homogeneous area is an area that, based on the inspector's judgment, contains materials that are uniform in color and texture and are present on similar building or utility components. Asbestos sample locations are shown on Figures 1 through 4.

2.1 Asbestos Sampling Results

Locations and occurrences of materials that tested positive and are homogenous (similar in color and texture) in nature are considered as ACM. A material is defined by the MEDEP as an asbestos-containing material if it contains greater than or equal to one percent (1%) asbestos based on laboratory analysis. A material can only be considered negative for asbestos if analytical results from all bulk samples in a group of samples representing that material indicate an asbestos content of less than 1%.

Interior:

ACM identified by laboratory analysis consisted of:

- Floor tile with non-ACM adhesive present in the sound booths and press boxes;
- Floor tile and associated ACM adhesive present along the east end of the ice rink;

- Floor tile and associated ACM adhesive present in the entry hall outside the restaurant kitchen: and
- Large diameter cementitious transite conduit used as utility conduit in the ticket booth and in the mechanical tunnel on the northern side of the arena. It appears that the transite conduit was used to house ventilation ducts running under the concrete floor within the building. This could not be confirmed, however it should be assumed that the transite conduit is present under the floor;

Exterior:

ACM was not identified on the exterior of the building.

An inventory of identified ACM is included in Table 1. Locations of identified ACM are presented on Figures 1 through 4.

Cost estimates (as presented in Table 1) have been prepared to provide a budget for removal of ACM identified during the survey. These estimates do not include material replacement costs, regulatory agency notification fees or a contingency. Estimates assume the Contractor will be responsible to prepare the asbestos abatement design(s). Regulatory agency notification fees associated with this project will range from $100.00 to $300.00 depending phasing and project schedule. Actual abatement costs may vary depending upon the amount of ACM abated and abatement methods utilized.

3.0 HAZARDOUS MATERIALS ASSESSMENT

Summit conducted a Hazardous Materials Assessment on March 15, 2012. The intent of this assessment was to identify materials used or stored at the CCCC that would require removal and proper disposal prior to impact by renovation and/or demolition activities. To assess current conditions, Summit conducted a walkthrough of accessible interior areas, as well as the building exterior.

In addition to hazardous materials observed during this assessment, an unregistered underground storage tank (UST) is located within a HVAC impoundment on the eastern end of the building below cooling equipment. The UST is reportedly is a 500-gallon diesel fuel tank installed between 1975 and 1976 and is associated with the facility's emergency generator. The UST has reportedly not been serviced or refilled after the initial filling (1975-76). The condition of the UST and surrounding soils is unknown.

A summary of identified hazardous materials and associated estimate for removal and disposal of these materials is included in Table 2.

4.0 LEAD-BASED PAINT DETERMINATION

A LBP determination of the CCCC was conducted by Atlantic Environmental Services (AES) a Summit sub-consultant, on March 15, 2012. Deborah A. Kasik, a MEDEP certified Lead Risk Assessor, performed the determination. The purpose of the determination was to identify materials with LBP. The lead-based paint testing was performed in accordance with the *established protocols* outlined in the *State of Maine Department of Environmental Protection's*

Lead Management Regulations, Chapter 424, Section 7, as they apply to this project. The testing provides information on the LBP content and assessment of condition for the surfaces tested.

The LBP testing was conducted utilizing a portable X-ray Fluorescence Lead Paint Analyzer (RMD LPA-1), which non-destructively tests for the presence of lead-based paint. This equipment is licensed with the Department of Human Services Radiation Control Program and operated in accordance with all applicable regulations and conditions of licensure.

LBP was identified on the following surfaces:

Location	**LBP Materials**
Ladies Rooms	Entry walls only (previously marked with an arrow). Each wall is approximately 4 feet square;
Arena Area	Large "ROW" lettering on cinderblock walls around the perimeter of the arena painted in either black or in orange;
Utility Closets	Glazing on utility sinks; and
Administrative Offices	Vinyl baseboards.

LBP was not identified on the exterior surfaces.

A copy of the LBP determination report including a sketch showing LBP locations and field forms is included as Appendix D.

5.0 PCB-CONTAINING CAULK ASSESSMENT

PCBs were used as a plasticizer in caulking and in elastic sealant materials, primarily from 1950 through 1978. The caulk/sealants were used in windows and associated window systems, door frames, stairways, masonry columns and other masonry building materials. PCBs were not used in these materials after 1978. Consistent with USEPA guidelines, PCB-containing caulking has a PCB content of equal to or greater than 50 parts per million ($\geq$ 50 ppm). At this level, the caulk containing PCBs is not an authorized use under the current PCB regulations and must be removed. When removed, these materials are considered a controlled hazardous waste material under the Toxic Substance Control Act (TSCA).

Summit conducted a limited PCB-caulking field screening on March 15, 2012. During the screening, homogeneous caulking/glazing types present on window and door systems affected by the planned renovation project were noted and classified by system or use (e.g.; caulking associated with the junction of window frames and the surrounding substrate; or caulking associated with the wall junctions, etc.). Ten representative samples of window and door caulking were collected from the following systems impacted by the planned renovation:

- Large panel windows located on the northeast, northwest, southeast and southwest corners of the building; and
- Entry doors.

The suspect PCB samples were placed in laboratory provided containers and shipped to Analytics Environmental Laboratory LLC (Analytics) of Portsmouth, New Hampshire for analysis using USEPA Method SW-846-8082 and sample preparation Method SW-846 3540C (Soxhlet extraction). Laboratory analytical results were "non-detect" for all caulking samples. Laboratory analysis reports are included in Appendix E.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the Asbestos Identification Survey and observations made during the Hazardous Materials Assessment this investigation revealed the following relevant information:

1. Eighty-three (83) bulk samples of suspect ACM were collected for asbestos analysis from interior and exterior building materials.

   ACM identified by laboratory analysis consisted of:

   - Floor tile with non-ACM adhesive present in the sound booths and press boxes;
   - Floor tile and associated ACM adhesive present along the east end of the ice rink;
   - Floor tile and associated ACM adhesive present in the entry hall outside the restaurant kitchen: and
   - Large diameter cementitious transite conduit used as utility conduit in the ticket booth and in the mechanical tunnel on the northern side of the arena. It appears that the transite conduit was used to house ventilation ducts running under the concrete floor within the building. This could not be confirmed, however it should be assumed that the transite conduit is present under the floor;

2. Potential Universal Wastes including fluorescent lights and light ballasts were identified during the survey. Those ballasts not labeled as "no-PCB" should be segregated and handled as hazardous waste. Additional materials (sodium vapor lamps and mercury thermostats) requiring special handling were identified. Additional materials (a mercury thermostat) requiring special handling were identified.
3. A LBP determination was conducted using a portable X-Ray Fluorescence (XRF) Lead Paint Analyzer to determine the presence of LBP on identified painted interior and exterior surfaces. LBP was identified on surfaces throughout the interior
4. Ten bulk samples of the window/door caulking were collected from the interior and exterior of the building and analyzed for the presence of Polychlorinated Biphenyl (PCB). Laboratory analytical results were "non-detect" for the caulking samples.
5. An unregistered underground storage tank (UST) is located within a HVAC impoundment on the eastern end of the building below cooling equipment. The UST is reportedly is a 500-gallon diesel fuel tank installed between 1975 and 1976 and is associated with the facility's emergency generator. The UST has reportedly not been serviced or refilled after the initial filling (1975-76). The condition of the UST and

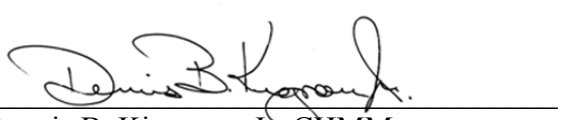
surrounding soils is unknown. The unregistered UST located on the eastern end of the building must be registered with the MEDEP, additionally a notice of intent to remove or abandon the UST should be filed with the registration forms to comply with current UST regulations.

6. Electrical transformers are present beneath the stadium seating. Electrical transformers may contain PCB oil, which if present must be handled as hazardous waste.

7.0 REPORT CERTIFICATION

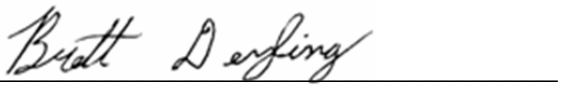
This report was prepared and reviewed by Summit Environmental Consultants, Inc. for the sole use of the Cumberland County Recreation Center and its constituents and should not be reproduced without their full, written authorization.

Inspectors:



Dennis B. Kingman, Jr. CHMM

Maine DEP License No AI-0034

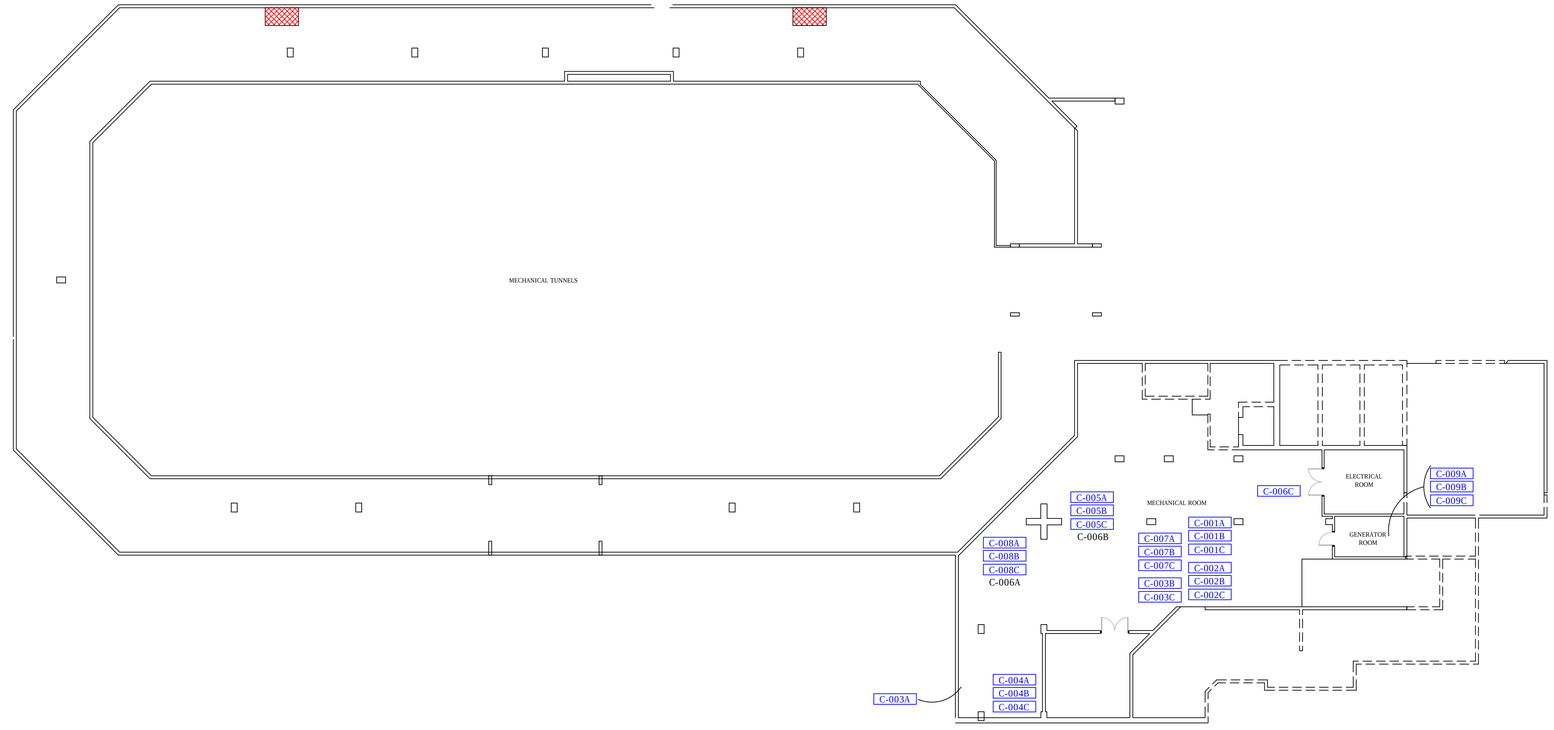


Brett Deyling
Staff Engineer
Maine DEP License No AI-0605

Figures

Figure 1

Mechanical Level



LEGEND

- C-001A = SAMPLE NUMBER AND LOCATION TESTING POSITIVE FOR ASBESTOS
- C-002A = SAMPLE NUMBER AND LOCATION TESTING NEGATIVE FOR ASBESTOS
- C-001B = SAMPLE NUMBER AND LOCATION NOT ANALYZED (POSITIVE STOP)
- = ACM FLOOR TILE WITH NON-ACM ADHESIVE
- = ACM FLOOR TILE WITH ACM ADHESIVE
- = NON-ACM FLOOR TILE WITH ACM ADHESIVE
- = TRANSITE CONDUIT (1.5' DIAMETER)

1/16" = 1'-0"

0 1 2 3 4

Source:

FLOOR PLAN DERIVED FROM DRAWINGS BY OTHERS PROVIDED TO SUMMIT AND ARE NOT WARRANTED AS TO ACCURACY.

123051AIS.DWG

PROJ. # 12-3051.0

SHEET NUMBER

AA-1

NO.	DATE

DRAWN BY: BOMAC

DESIGNED BY:

APPROVED BY: D.B.K.

TITLE: ASBESTOS IDENTIFICATION SURVEY MECHANICAL LEVEL

SCALE: AS SHOWN

DATE: MARCH 30, 2012

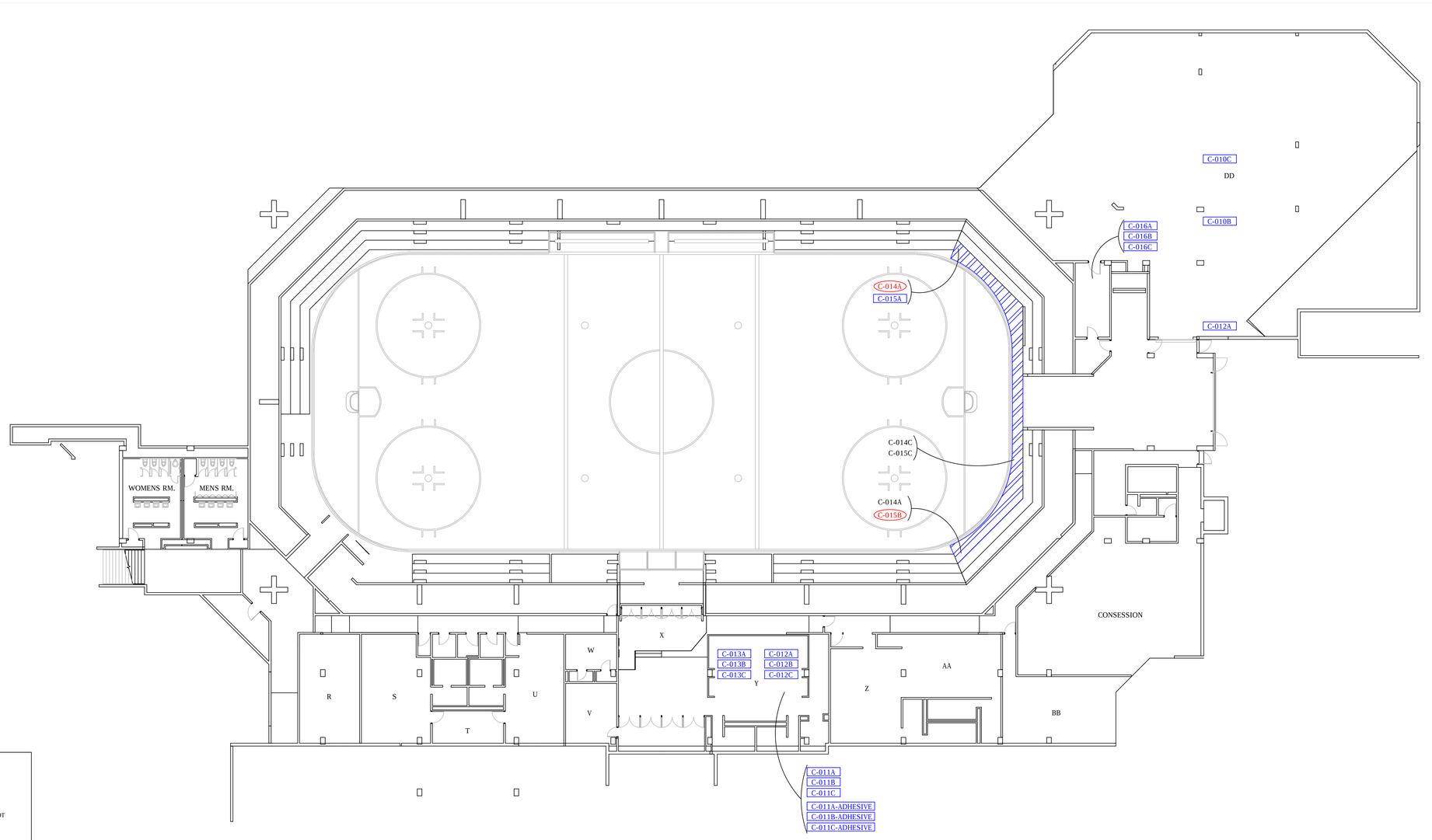
PROJECT: CUMBERLAND COUNTY CIVIC CENTER . CUMBERLAND, ME.

CLIENT: CUMBERLAND COUNTY RECREATIONAL CENTER . CUMBERLAND, MAINE

Summit Environmental Consultants, Inc.
8 HARLOW ST. SUITE 4A · BANGOR, Maine 04401
TEL. (207)262-9040 · FAX. (207)262-9080

Figure 2

Event Level



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123051AIS.DWG

PROJ. # 12-3051.0

SHEET NUMBER

AA-2

NO.	DATE	
		DRAWN BY: BOMAC
		DESIGNED BY:
		APPROVED BY: D.B.K.

TITLE: ASBESTOS IDENTIFICATION SURVEY EVENT LEVEL

SCALE: AS SHOWN

DATE: MARCH 30, 2012

PROJECT: CUMBERLAND COUNTY CIVIC CENTER . CUMBERLAND, ME.

CLIENT: CUMBERLAND COUNTY RECREATIONAL CENTER . CUMBERLAND, MAINE

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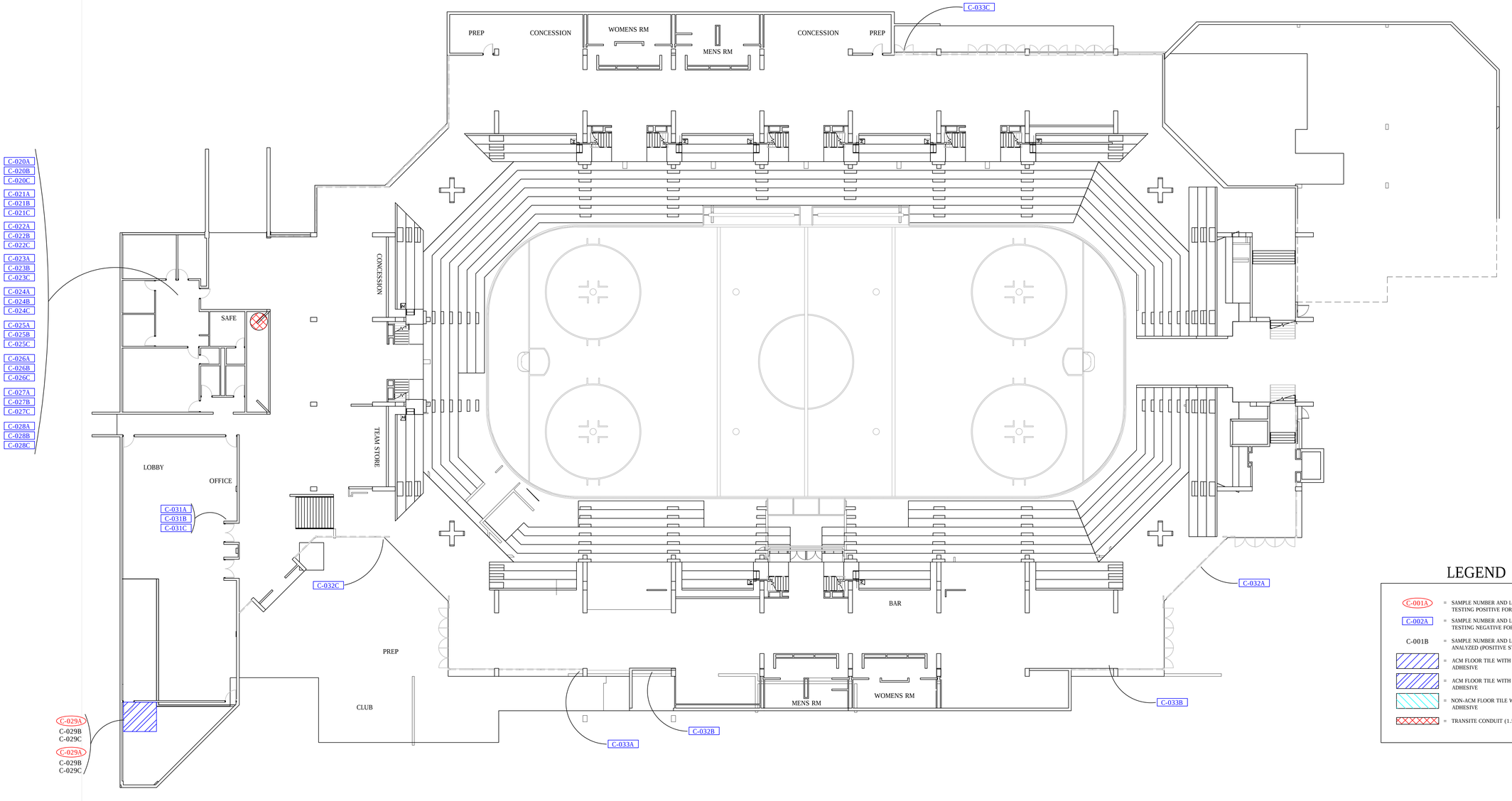
Figure 3

Concourse Level



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	= TRANSITE CONDUIT (1.5' DIAMETER)

1/16" = 1'-0"

0 1 2 3 4

Source:

FLOOR PLAN DERIVED FROM DRAWINGS BY OTHERS PROVIDED TO SUMMIT AND ARE NOT WARRANTED AS TO ACCURACY.

123051AIS.DWG

PROJ. # 12-3051.0

SHEET NUMBER

AA-3

NO.	DATE	
		DRAWN BY: BOMAC
		DESIGNED BY:
		APPROVED BY: D.B.K.

ASBESTOS IDENTIFICATION SURVEY
CONCOURSE LEVEL

TITLE:

SCALE: AS SHOWN

DATE: MARCH 30, 2012

PROJECT: CUMBERLAND COUNTY CIVIC CENTER
CUMBERLAND, ME.

CLIENT: CUMBERLAND COUNTY RECREATIONAL CENTER
CUMBERLAND, MAINE

Summit
Environmental Consultants, Inc.
8 HARLOW ST. SUITE 4A · BANGOR, Maine 04401
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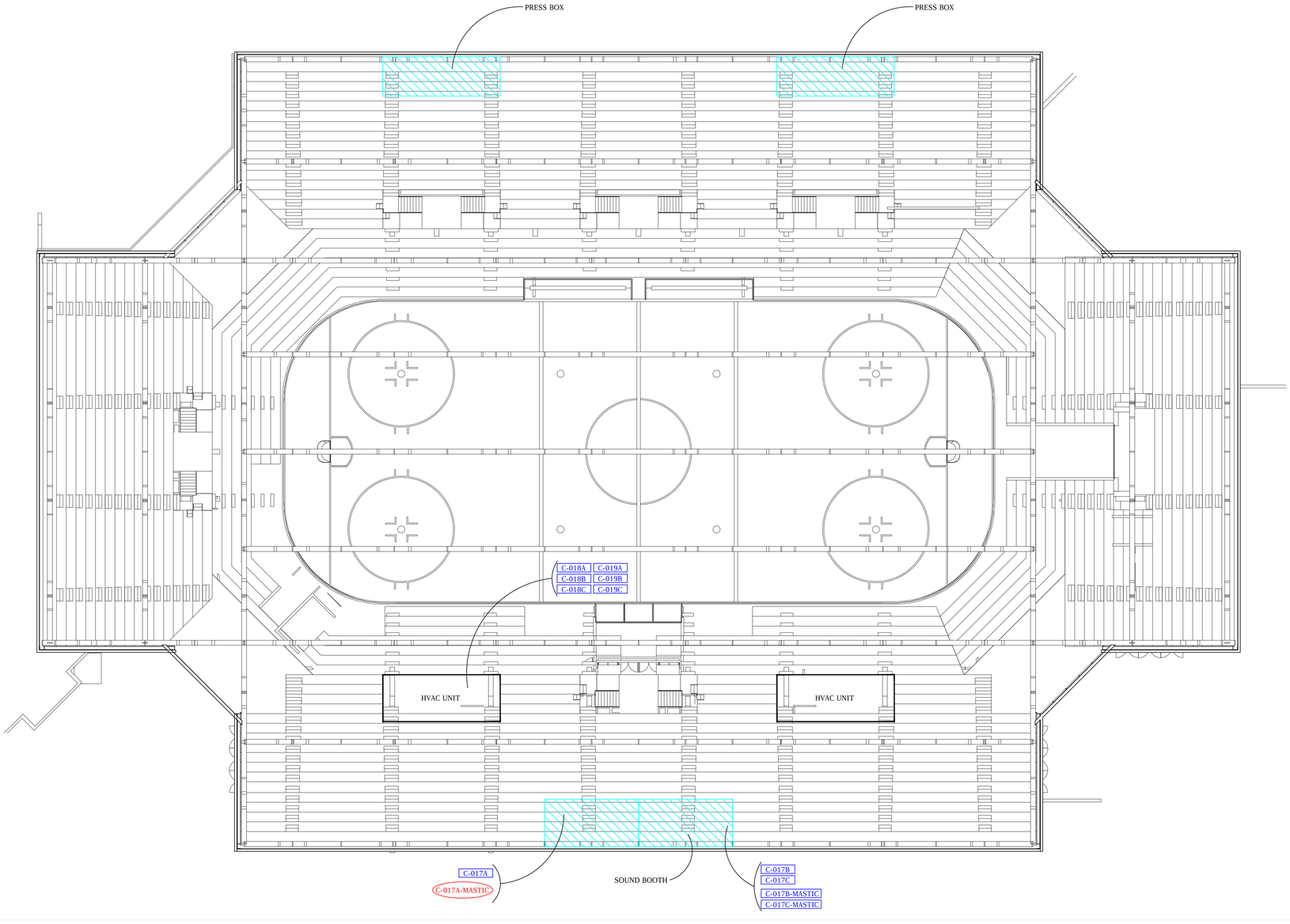
Figure 4

Catwalk Level



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1/16" = 1'-0"

0 1 2 3 4

Source:

FLOOR PLAN DERIVED FROM DRAWINGS BY OTHERS PROVIDED TO SUMMIT AND ARE NOT WARRANTED AS TO ACCURACY.

123051AIS.DWG

PROJ. # 12-3051.0

SHEET NUMBER

AA-4

NO.	DATE	
		DRAWN BY: BOMAC
		DESIGNED BY:
		APPROVED BY: D.B.K.

TITLE: ASBESTOS IDENTIFICATION SURVEY CATWALK LEVEL

SCALE: AS SHOWN

DATE: MARCH 30, 2012

CLIENT: CUMBERLAND COUNTY RECREATIONAL CENTER · CUMBERLAND, MAINE

PROJECT: CUMBERLAND COUNTY CIVIC CENTER · CUMBERLAND, ME.

Summit Environmental Consultants, Inc.
8 HARLOW ST. SUITE 4A · BANGOR, Maine 04401
TEL. (207)262-9040 · FAX. (207)262-9080

Tables

Table 1

SUMMARY OF ASBESTOS CONTAINING MATERIALS

TABLE 1

Identified ACM	Sample Number	Total Estimated Quantity	Unit	Unit Cost	Estimated Removal Cost
North end by ice rink - 12x12 inch gray floor tile and associated mastic	C-014A	240	SF	$6/SF	$1,440
Sound Booth and Press Boxes - 12x12 inch beige floor tile	C-017A	240	SF	$5/SF	$1,200
Kitchen Exit - 12x12 brown speck floor tile and associated mastic	C-029A	80	SF	$6/SF	$480
Ticket Booth and north tunnel - Transite Piping	Assumed ACM and not sampled	100	LF	$25/LF	$2,500
TOTAL					**$5,620.00**

Table 2

HAZARDOUS MATERIALS INVENTORY

TABLE 2

Materials	Estimated Quantity	Unit	Unit Cost	Remediation Cost
Fluorescent Light Tubes	5218	Linear Foot of Light Tube	$0.20	$1,044
Suspect PCB-Containing Light Ballasts	640	Each	$0.50	$320
Electric Transformers	2	Each	$100	$200
Sodium Vapor Lamps	100	Pounds	$0.50	$50
Mercury Thermostat	1	Each	$8	$8
UST	1	Lump Sum	$40,000	$40,000
Transportation	10	Per Pickup	$100	$1,000
Labor to Consolidate & Pack for Shipment	10	Manday	$500	$5,000
ESTIMATED TOTAL COST				**50,000**

Appendices

Appendix A

ASBESTOS LABORATORY ANALYTICAL RESULTS

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com / cinnasblab@EMSL.com

EMSL Order ID: 041206868
Customer ID: SUMM78
Customer PO:
Project ID:

Attn: Dennis Kingman
Summit Environmental Consultants, Inc.
8 Harlow Street
Suite 4A
Bangor, ME 04401

Phone: (207) 262-9040
Fax: (207) 262-9080
Collected: 3/16/2012
Received: 3/19/2012
Analyzed: 3/23/2012

Proj: 12-/Cumberland County Civic Center/Portland

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-001A ***Lab Sample ID:*** **041206868-0001**
Sample Description: Boiler A/Refractory cement

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	0%	100%	None Detected	

Client Sample ID: C-001B ***Lab Sample ID:*** **041206868-0002**
Sample Description: Boiler A/Refractory cement

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	0%	100%	None Detected	

Client Sample ID: C-001C ***Lab Sample ID:*** **041206868-0003**
Sample Description: Boiler A/Refractory cement

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	0%	100%	None Detected	

Client Sample ID: C-002A ***Lab Sample ID:*** **041206868-0004**
Sample Description: Boiler A/Rope Gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	95%	5%	None Detected	

Client Sample ID: C-002B ***Lab Sample ID:*** **041206868-0005**
Sample Description: Boiler A/Rope Gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	95%	5%	None Detected	

Client Sample ID: C-002C ***Lab Sample ID:*** **041206868-0006**
Sample Description: Boiler A/Rope Gasket

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Tan/White	95%	5%	None Detected	

Client Sample ID: C-003A ***Lab Sample ID:*** **041206868-0007**
Sample Description: By water boiler/Small diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	25%	75%	None Detected	

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Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-003B **Lab Sample ID:** **041206868-0008**
Sample Description: By X-tank #1/Small diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	40%	60%	None Detected	

Client Sample ID: C-003C **Lab Sample ID:** **041206868-0009**
Sample Description: By X-tank #1/Small diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-004A **Lab Sample ID:** **041206868-0010**
Sample Description: Water main/Large diameter water line fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-004B **Lab Sample ID:** **041206868-0011**
Sample Description: Water main/Large diameter water line fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-004C **Lab Sample ID:** **041206868-0012**
Sample Description: Water main/Large diameter water line fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-005A **Lab Sample ID:** **041206868-0013**
Sample Description: Chiller B/Brine pump fitting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-005B **Lab Sample ID:** **041206868-0014**
Sample Description: Chiller B/Brine pump fitting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-005C **Lab Sample ID:** **041206868-0015**
Sample Description: Chiller B/Brine pump fitting

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	65%	35%	None Detected	The sample group is not homogeneous

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Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-006A ***Lab Sample ID:*** **041206868-0016**
Sample Description: Large diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-006B ***Lab Sample ID:*** **041206868-0017**
Sample Description: Large diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-006C ***Lab Sample ID:*** **041206868-0018**
Sample Description: Large diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-007A ***Lab Sample ID:*** **041206868-0019**
Sample Description: Top/X-tank #1 end cap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-007B ***Lab Sample ID:*** **041206868-0020**
Sample Description: Top/X-tank #1 end cap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-007C ***Lab Sample ID:*** **041206868-0021**
Sample Description: Bottom/X-tank #1 end cap

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-008A ***Lab Sample ID:*** **041206868-0022**
Sample Description: Medium diameter pipe fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-008B ***Lab Sample ID:*** **041206868-0023**
Sample Description: Medium diameter pipe fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

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Customer ID: SUMM78
Customer PO:
Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-008C ***Lab Sample ID:*** **041206868-0024**
Sample Description: Medium diameter pipe fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-009A ***Lab Sample ID:*** **041206868-0025**
Sample Description: Generator/Exhaust insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	20%	80%	None Detected	

Client Sample ID: C-009B ***Lab Sample ID:*** **041206868-0026**
Sample Description: Generator/Exhaust insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	40%	60%	None Detected	

Client Sample ID: C-009C ***Lab Sample ID:*** **041206868-0027**
Sample Description: Generator/Exhaust insulation

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Beige	18%	82%	None Detected	

Client Sample ID: C-010A ***Lab Sample ID:*** **041206868-0028**
Sample Description: Maintenance area/Roof drain fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-010B ***Lab Sample ID:*** **041206868-0029**
Sample Description: Maintenance area/Roof drain fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-010C ***Lab Sample ID:*** **041206868-0030**
Sample Description: Maintenance area/Roof drain fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-011A ***Lab Sample ID:*** **041206868-0031**
Sample Description: Room Y/Acoustic wall cover

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	25%	75%	None Detected	

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Client Sample ID: C-011B **Lab Sample ID:** **041206868-0032**
Sample Description: Room Y/Acoustic wall cover

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	25%	75%	None Detected	

Client Sample ID: C-011C-Wallpaper **Lab Sample ID:** **041206868-0033**
Sample Description: Room Y/Acoustic wall cover

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	25%	75%	None Detected	

Client Sample ID: C-011C-Adhesive **Lab Sample ID:** **041206868-0033A**
Sample Description: Room Y/Acoustic wall cover

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	0%	100%	None Detected	

Client Sample ID: C-012A **Lab Sample ID:** **041206868-0034**
Sample Description: Room Y/T1 Ceiling tile (small pattern)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Brown	90%	10%	None Detected	

Client Sample ID: C-012B **Lab Sample ID:** **041206868-0035**
Sample Description: Room Y/T1 Ceiling tile (small pattern)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-012C **Lab Sample ID:** **041206868-0036**
Sample Description: Room Y/T1 Ceiling tile (small pattern)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-013A **Lab Sample ID:** **041206868-0037**
Sample Description: Room Y/T2 Ceiling tile (large pattern)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-013B **Lab Sample ID:** **041206868-0038**
Sample Description: Room Y/T2 Ceiling tile (large pattern)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

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Customer ID: SUMM78
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Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-013C ***Lab Sample ID:*** **041206868-0039**

Sample Description: Room Y/T2 Ceiling tile (large pattern)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-014A ***Lab Sample ID:*** **041206868-0040**

Sample Description: N end by ice rink/12x12 gray floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Gray	0.0%	93.0%	**7.0% Chrysotile**	

Client Sample ID: C-014B ***Lab Sample ID:*** **041206868-0041**

Sample Description: N end by ice rink/12x12 gray floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-014C ***Lab Sample ID:*** **041206868-0042**

Sample Description: N end by ice rink/12x12 gray floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-015A ***Lab Sample ID:*** **041206868-0043**

Sample Description: N end by ice rink/Floor tile adhesive assoc. w/ 014A

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	**<0.30% Chrysotile**	

Client Sample ID: C-015B ***Lab Sample ID:*** **041206868-0044**

Sample Description: N end by ice rink/Floor tile adhesive assoc. w/ 014B

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Gray	0.0%	99.0%	**1.0% Chrysotile**	

Client Sample ID: C-015C ***Lab Sample ID:*** **041206868-0045**

Sample Description: N end by ice rink/Floor tile adhesive assoc. w/ 014C

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	**<0.36% Chrysotile**	

Client Sample ID: C-016A ***Lab Sample ID:*** **041206868-0046**

Sample Description: LEO office/2x4 ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

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EMSL Order ID: 041206868
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Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-016B **Lab Sample ID:** **041206868-0047**
Sample Description: LEO office/2x4 ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-016C **Lab Sample ID:** **041206868-0048**
Sample Description: LEO office/2x4 ceiling tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-017A-Floor Tile **Lab Sample ID:** **041206868-0049**
Sample Description: Sound Booth/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan	0.0%	98.3%	**1.7% Chrysotile**	

Client Sample ID: C-017A-Mastic **Lab Sample ID:** **041206868-0049A**
Sample Description: Sound Booth/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Brown	0.0%	100%	None Detected	

Client Sample ID: C-017B-Floor Tile **Lab Sample ID:** **041206868-0050**
Sample Description: Sound Booth/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-017B-Mastic **Lab Sample ID:** **041206868-0050A**
Sample Description: Sound Booth/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Brown	0.0%	100%	None Detected	

Client Sample ID: C-017C **Lab Sample ID:** **041206868-0051**
Sample Description: Sound Booth/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-018A **Lab Sample ID:** **041206868-0052**
Sample Description: SE HVAC Room/Small diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	40%	60%	None Detected	

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Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-018B **Lab Sample ID:** **041206868-0053**
Sample Description: SE HVAC Room/Small diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-018C **Lab Sample ID:** **041206868-0054**
Sample Description: SE HVAC Room/Small diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	25%	75%	None Detected	

Client Sample ID: C-019A **Lab Sample ID:** **041206868-0055**
Sample Description: SE HVAC Room/Large diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	30%	70%	None Detected	

Client Sample ID: C-019B **Lab Sample ID:** **041206868-0056**
Sample Description: SE HVAC Room/Large diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray/Yellow	50%	50%	None Detected	

Client Sample ID: C-019C **Lab Sample ID:** **041206868-0057**
Sample Description: SE HVAC Room/Large diameter fittings

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	25%	75%	None Detected	

Client Sample ID: C-020A **Lab Sample ID:** **041206868-0058**
Sample Description: Front Director Office/12x12 white pink floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Gray	0.0%	100%	None Detected	

Client Sample ID: C-020B **Lab Sample ID:** **041206868-0059**
Sample Description: Front Director Office/12x12 white pink floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Gray	0.0%	100%	None Detected	

Client Sample ID: C-020C **Lab Sample ID:** **041206868-0060**
Sample Description: Front Director Office/12x12 white pink floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Gray	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-021A **Lab Sample ID:** **041206868-0061**

Sample Description: Front Director Office/Adhesive assoc w/ 020A

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Yellow	0.0%	100%	None Detected	

Client Sample ID: C-021B **Lab Sample ID:** **041206868-0062**

Sample Description: Front Director Office/Adhesive assoc w/ 020B

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Yellow	0.0%	100%	None Detected	

Client Sample ID: C-021C **Lab Sample ID:** **041206868-0063**

Sample Description: Front Director Office/Adhesive assoc w/ 020C

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Yellow	0.0%	100%	None Detected	

Client Sample ID: C-022A **Lab Sample ID:** **041206868-0064**

Sample Description: Front Director Office/Ceiling tile (TB)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Tan	95%	5%	None Detected	

Client Sample ID: C-022B **Lab Sample ID:** **041206868-0065**

Sample Description: Front Director Office/Ceiling tile (TB)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Tan	90%	10%	None Detected	

Client Sample ID: C-022C **Lab Sample ID:** **041206868-0066**

Sample Description: Front Director Office/Ceiling tile (TB)

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Tan	90%	10%	None Detected	

Client Sample ID: C-023A **Lab Sample ID:** **041206868-0067**

Sample Description: Director-Bathroom/Pattern floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan /Black	0.0%	100%	None Detected	

Client Sample ID: C-023B **Lab Sample ID:** **041206868-0068**

Sample Description: Director-Bathroom/Pattern floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan /Black	0.0%	100%	None Detected	

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Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.emsl.com / cinnasblab@EMSL.com

EMSL Order ID: 041206868
Customer ID: SUMM78
Customer PO:
Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-023C **Lab Sample ID:** **041206868-0069**
Sample Description: Director-Bathroom/Pattern floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan /Black	0.0%	100%	None Detected	

Client Sample ID: C-025A **Lab Sample ID:** **041206868-0070**
Sample Description: Director Office/Sheetrock walls

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	10%	90%	None Detected	

Client Sample ID: C-025B-Drywall **Lab Sample ID:** **041206868-0071**
Sample Description: Director Office/Sheetrock walls

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	10%	90%	None Detected	

Client Sample ID: C-025B-Joint Compound **Lab Sample ID:** **041206868-0071A**
Sample Description: Director Office/Sheetrock walls

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	0%	100%	None Detected	

Client Sample ID: C-025C-Drywall **Lab Sample ID:** **041206868-0072**
Sample Description: Director Office/Sheetrock walls

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	15%	85%	None Detected	

Client Sample ID: C-025C-Joint Compound **Lab Sample ID:** **041206868-0072A**
Sample Description: Director Office/Sheetrock walls

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	White	0%	100%	None Detected	

Client Sample ID: C-026A **Lab Sample ID:** **041206868-0073**
Sample Description: Reception/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan	0.0%	100%	None Detected	

Client Sample ID: C-026B **Lab Sample ID:** **041206868-0074**
Sample Description: Reception/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan	0.0%	100%	None Detected	

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Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-026C-Floor Tile **Lab Sample ID:** **041206868-0075**
Sample Description: Reception/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan	0.0%	100%	None Detected	

Client Sample ID: C-026C-Mastic **Lab Sample ID:** **041206868-0075A**
Sample Description: Reception/12x12 beige floor tile

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Insufficient Material	

Client Sample ID: C-027A **Lab Sample ID:** **041206868-0076**
Sample Description: Reception/2X4 ceiling tile -TA

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-027B **Lab Sample ID:** **041206868-0077**
Sample Description: Reception/2X4 ceiling tile -TA

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-027C **Lab Sample ID:** **041206868-0078**
Sample Description: Reception/2X4 ceiling tile -TA

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	80%	20%	None Detected	

Client Sample ID: C-028A **Lab Sample ID:** **041206868-0079**
Sample Description: Office Hallway "TC"/2X2 pinhole ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-028B **Lab Sample ID:** **041206868-0080**
Sample Description: Office Hallway "TC"/2X2 pinhole ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-028C **Lab Sample ID:** **041206868-0081**
Sample Description: Office Hallway "TC"/2X2 pinhole ceiling

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	85%	15%	None Detected	

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Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-029A **Lab Sample ID:** **041206868-0082**
Sample Description: Kitchen Exit/12x12 brown speck FT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Tan	0.0%	98.6%	**1.4% Chrysotile**	

Client Sample ID: C-029B **Lab Sample ID:** **041206868-0083**
Sample Description: Kitchen Exit/12x12 brown speck FT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-029C **Lab Sample ID:** **041206868-0084**
Sample Description: Kitchen Exit/12x12 brown speck FT

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-030A **Lab Sample ID:** **041206868-0085**
Sample Description: Kitchen Exit/Adhesive assoc. w/ 029A

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	95.6%	**4.4% Chrysotile**	

Client Sample ID: C-030B **Lab Sample ID:** **041206868-0086**
Sample Description: Kitchen Exit/Adhesive assoc. w/ 029B

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-030C **Lab Sample ID:** **041206868-0087**
Sample Description: Kitchen Exit/Adhesive assoc. w/ 029C

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012				Positive Stop (Not Analyzed)	

Client Sample ID: C-031A **Lab Sample ID:** **041206868-0088**
Sample Description: Lounges/2x4 ceiling tile TD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-031B **Lab Sample ID:** **041206868-0089**
Sample Description: Lounges/2x4 ceiling tile TD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

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Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

Client Sample ID: C-031C ***Lab Sample ID:*** **041206868-0090**

Sample Description: Lounges/2x4 ceiling tile TD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	3/23/2012	Gray	90%	10%	None Detected	

Client Sample ID: C-032A ***Lab Sample ID:*** **041206868-0091**

Sample Description: Exterior/Window caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	None Detected	

Client Sample ID: C-032B ***Lab Sample ID:*** **041206868-0092**

Sample Description: Exterior/Window caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	None Detected	Sample is not homogeneous. Recommend TEM

Client Sample ID: C-032C ***Lab Sample ID:*** **041206868-0093**

Sample Description: Exterior/Window caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	None Detected	

Client Sample ID: C-033A ***Lab Sample ID:*** **041206868-0094**

Sample Description: Interior/Window caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	None Detected	

Client Sample ID: C-033B ***Lab Sample ID:*** **041206868-0095**

Sample Description: Interior/Window caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	None Detected	

Client Sample ID: C-033C ***Lab Sample ID:*** **041206868-0096**

Sample Description: Interior/Window caulk

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM Grav. Reduction	3/23/2012	Black	0.0%	100%	None Detected	

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EMSL Order ID: 041206868
Customer ID: SUMM78
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Project ID:

Summary Test Report for Asbestos Analysis via EPA 600/R-93/116 and/or EPA 600/M4-82-020

PLM: ME Cert #BA-0137 (JY) #BA-0134

PLM EPA NOB: ME Cert #BA-0134

Analyst(s)

Frank Dicrescenzo	PLM	(41)
	PLM Grav. Reduction	(7)
Johnny Yu	PLM	(25)
	PLM Grav. Reduction	(20)

Stephen Siegel, CIH, Laboratory Manager
or other Approved Signatory

Any questions please contact Steve Siegel.

Initial report from: 03/23/201211:14:35

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Your Name: Dennis Kingman **Project Manager:** DBK

Company: Summit Environmental Consultants, Inc.

Street: 8 Harlow Street, Suite 4A

City/State/Zip: Bangor, Maine 04401

Phone: 207-262-9040 **Fax:** 207-262-9080 **Email:** dkingman@summitenv.com

Project Name Cumberland County Civic Center **Project #:** 12 -

Project Location: Portland **Project State (US):** ME

TURNAROUND TIME

☐ 3 Hours	☐ 6 Hours	☐ 12 Hours	☐ 24 Hours	☐ 48 Hours	☐ 72 Hours	☒ 4 Days	☐ 5 Days	☐ 6-10 Days

SAMPLE MATRIX

☐ Air	☒ Bulk	☐ Soil	☐ Wipe	☐ Micro-Vac	☐ Drinking Water	☐ Wastewater	☐ Chips	☐ Other

ASBESTOS ANALYSIS

PCM - Air
- ☐ NIOSH 7400 (A) Issue 2: August 1994
- ☐ OSHA w/TWA

TEM AIR
- ☐ AHERA 40 CFR, Part 763 Subpart E
- ☐ NIOSH 7402 Issue 2
- ☐ EPA Level II

PLM – Bulk
- ☒ EPA 600/R-93/116 *see comments
- ☐ NY Stratified Point Count
- ☐ California Air Resource Board (CARB) 435
- ☐ NIOSH 9002
- ☐ PLM NOB (Gravimetric) NYS 198.1
- ☐ EPA Point Count (400 Points)
- ☐ EPA Point Count (1,000 Points)
- ☐ Standard Addition Point Count

SOILS
- ☐ EPA Protocol Qualitative
- ☐ EPA Protocol Quantitative
- ☐ EMSL MSD 9000 Method fibers/gram
- ☐ Superfund EPA 540-R097-028 (dust generation)

TEM BULK
- ☐ Drop Mount (Qualitative)
- ☐ Chatfield SOP-1988-02
- ☐ TEM NOB (Gravimetric) NY 198.4

TEM MICROVAC
- ☐ ASTM D 5755-95 (Quantitative)

TEM WIPE
- ☐ ASTM D-6480-99
- ☐ Qualitative ☐

TEM WATER
- ☐ EPA 100.1
- ☐ EPA 100.2
- ☐ NYS 198.2
- ☐ Other:

LEAD ANALYSIS

Flame Atomic Absorption
- ☐ Wipe, SW846-7420 ☐ ASTM ☐ non ASTM
- ☐ Soil, SW846-7420
- ☐ Air, NIOSH 7082
- ☐ Chips, SW846-7420 or AOAC 5.009 (974.02)
- ☐ Wastewater, SW 846-7420
- ☐ TCLP LEAD SW846-1311/7420

Graphite Furnace Atomic Absorption
- ☐ Air, NIOSH 7105
- ☐ Wastewater, SW846-7421
- ☐ Soil, SW846-7421
- ☐ Drinking Water, EPA 239.2

ICP – Inductively Coupled Plasma
- ☐ Wipe, SW846-6010 ☐ ASTM ☐ non ASTM
- ☐ Soil, SW846-6010
- ☐ Air, NIOSH 7300

MATERIALS ANALYSIS
- ☐ Full Particle Identification
- ☐ Optical Particle Identification
- ☐ Dust Mites and Insect Fragments
- ☐ Particle Size & Distribution
- ☐ Product Comparison
- ☐ Paint Characterizaton
- ☐ Failure Analysis
- ☐ Corrosion Analysis
- ☐ Glove Box Containment Study
- ☐ Petrographic Examination of Concrete
- ☐ Portland Cement in Workplace Atmospheres (OSHA ID-143)
- ☐ Man Made Vitrous Fibers – MMVF's
- ☐ Synthetic Fiber Identification
- ☐ Other:

SAMPLES ACCEPTED FOR ANALYSIS BY EMSL ANALYTICAL INC

MICROBIAL ANALYSIS

Air Samples
- ☐ Mold & Fungi by Air O Cell
- ☐ Mold & Fungi by Agar Plate count & id
- ☐ Bacterial Count and Gram Stain
- ☐ Bacterial Count and Identification

Water Samples
- ☐ Total Coliforms, Fecal Coliforms
- ☐ Escherichia Coli, Fecal Streptococcus
- ☐ Legionella
- ☐ Salmonella
- ☐ Giardia and Cryptosporidium

Wipe and Bulk Samples
- ☐ Mold & Fungi – Direct Examination
- ☐ Mold & Fungi – (Culture follow up to direct examination if necessary)
- ☐ Mold & Fungi – Culture (Count & ID)
- ☐ Mold & Fungi – Culture (Count only)
- ☐ Bacterial Count & Gram Stain
- ☐ Bacterial Count & Identification (3 most prominent types)
- ☐ Other:

IAQ ANALYSIS
- ☐ Nuisance Dust (NIOSH 0500 & 0600)
- ☐ Airborne Dust (PM10, TSP)
- ☐ Silica Analysis by XRD ☐ Niosh 7500
- ☐ HVAC Efficiency
- ☐ Carbon Black
- ☐ Airborne Oil Mist
- ☐ Other:

2012 MAR 19 AM 10:16

Additional Information/Comments/Instructions: Positive Stop - NOB' per Maine DEP regs
NO SAMPLE # 24 TAKEN

Client Sample # (S) C-001A TOTAL SAMPLE #

Relinquished:	[signature]	Date:	3/16/2012	Time:	0830
Received:	[signature]	Date:	3/19/12	Time:	
Relinquished:		Date:	3-19-2012	Time:	8:45 am
Received:		Date:		Time:	

~~95~~ 96b

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	SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME Air (L)	Area (Inches sq.)
C	001 A	Refractory Cement - Boiler A		
	B	" "		
F	C	" "		
	002 A	Rope Gasket - Boiler A		
	B	" "		
N	C	" "		
	003 A	Small Diameter Fittings - by Water Boiler		
	B	" "	by X-TANK #1	
F	C	" "	by X-TANK #1	
	004 A	LARGE WATER MAIN Diameter Water lines Fittys		
	B	" "		
F	C	" "		
	005 A	BRine Pump fittys - chiller B		
	B	" "		
F	C	" "		
	006 A	LARGR Diameter Fittys		
	B			
F	C			
	007 A	X-TANK #1 END CAP -	top	
	B	" " -	top	
F	C	" " -	Boiler	
	008 A	medium Diameter Pipe Fittys		
	B	" "		
F	C	" "		

FOR ANALYSIS BY EMSL ANALYTICAL INC.

Relinquished: [signature] Date: 3/16 Time: 0820

Received: _____ Date: _____ Time: _____

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	SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME Air (L)	Area (Inches sq.)
	C-009 A	Generator exhaust insulation		
F	B	"		
	C	"		
	C-010 A	Roof Drain fitting - Maintenance Area		
F	B	"		
	C	"		
	C-011 A	Acoustic wall cover Room Y		
F	B	"		
	C	"		
	012 A	T1 ceiling tile (small pattern) Room Y		
F	B	"		
	C	"		
	013 A	T2 ceiling tile (large pattern) Room Y		
F	B	"		
	C	"		
	014 A	12x12 Gray floor tile - No end by ice Rink		
N	B	"		
	C	"		
	015 A	floor tile Adhesive ABOVE	014 A	
N	B	"	014 B	
	C	"	014 C	
	016 A	2x4 Ceiling tile - LEO office -		
F	B	"		
	C	"		

Relinquished: _____ Date: 3/16 Time: 0830

Received: _____ Date: _____ Time: _____

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SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME Air (L)	Area (Inches sq.)
C-017 A	12x12 Beige floortile - Sound Booth		
B	" "		
C	" "		
018 A	Small Diameter Fittings - SE HVAC Room		
B	" "		
C	" "		
019 A	Large Diameter Fittings - SE HVAC Room		
B	" "		
C	" "		
020 A	12x12 White Pink Floortile - Front Director office		
B	" "		
C	" "		
021 A	Adhesive Assoc w/ 020A		
B	" " 020B		
C	" " 020C		
022 A	Cove tile [TB] - Front Director office		
B	" "		
C	" "		
023 A	PATTERN Floor tile - Director - Bathroom		30SF
B			
C			
024 A	2x4 Cove tile - Reception - TA		
B	" "		
C	" "		

NOT SUBMITTED

CHAIN OF CUSTODY / LABORATORY ANALYSIS REQUEST FORM

Relinquished:		Date: 3/16	Time: 0830
Received:		Date:	Time:
Relinquished:		Date:	Time:
Received:		Date:	Time:

SAMPLE ACCEPTED FOR ANALYSIS BY EMSL ANALYTICAL INC

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	SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME Air (L)	Area (Inches sq.)
	C-025A	Sheet Rock walls - Director office		
F	B	" "		
	C	" "		
	026 A	12x12 ~~Beige~~ Beige Floor tile - Reception		
	B	" "		
N	C	" "		
	027 A	2x4 ceiling tile - TA - Reception		
F	B	" "		
	C	" "		
	028 A	2x2 pinhole ceiling - office hallway JC		
F	B	" "		
	C	" "		
	029 A	12x12 Brown speck FT - Kitchen grit		
N	B	" "		
	C	" "		
	030 A	Adhesive ~~ASBC~~ W/ 029A		
N	B	" " /029B		
	C	" " /029C		
	031 A	2x4 ceiling tile TD Break lounge		
F	B	" "		
	C	" "		
	032 A	Window Caulk - elevator		
N	B	" "		
	C	" "		

Relinquished: _____ Date: 3/16 Time: 0830

Received: _____ Date: _____ Time: _____

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SAMPLE NUMBER	SAMPLE DESCRIPTION/LOCATION	VOLUME Air (L)	Area (Inches sq.)
C-033 A	window caulk - exterior		
B			
N C			

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Received:		Date:	Time:
Relinquished:		Date:	Time:
Received:		Date:	

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CINNAMINSON, N.J.
2012 MAR 19 A 10:10

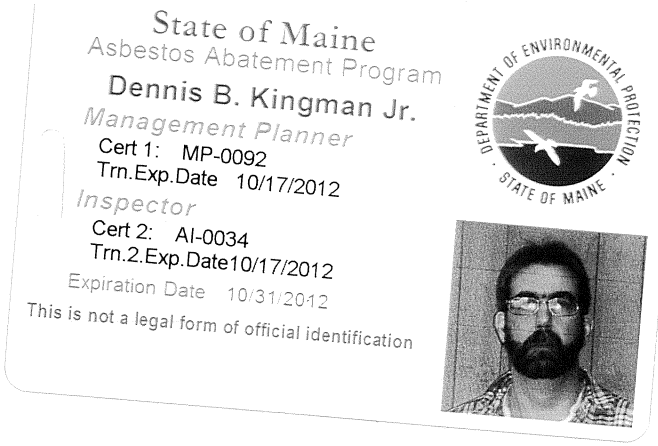
Appendix B

ASBESTOS INSPECTOR CERTIFICATIONS

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAUL R. LEPAGE
GOVERNOR

CIA W. AHO
MMISSIONER



November 28, 2011

Summit Environmental Consultants, Inc.
640 Main Street
Lewiston, Maine 04240

Dear Licensee:

Asbestos application(s) for individual certification of the **two** employee(s) listed below have been received and **approved**. Individual certification numbers are listed below and wallet card(s) are enclosed. Card(s) are property of the individual to whom each is issued. Your responsibility as a licensee is to ensure delivery of the cards to persons in your employment. This letter should be retained for your company files as record of certification.

Remember, in Maine all **certified employees** working on an asbestos abatement project, whether conducting removal/repair, air monitoring, design, inspection, or analysis functions, **must work for a State of Maine licensed asbestos firm** and carry his/her wallet card(s) on the job site.

As a reminder, prior to renewing your asbestos certification, the State of Maine **requires** an annual refresher course to be taken before submitting a renewal application. A certificate shall expire one year from the last day of the month from the date of issuance, **or on the last day of the month that the training certificate expires**, whichever is sooner. A listing of training providers is attached and it is your responsibility to ensure you have completed a renewal training course prior to your training expiration date.

All our asbestos forms can be found at http://www.maine.gov/dep/rwm/asbestos/newupdatedformsasb.htm. Thank you for your cooperation and your completed application(s).

Name	Category	Certification #	Exp. Date
Dennis B. Kingman Jr.	Management Planner	MP-0092	10/31/2012
Dennis B. Kingman Jr.	Inspector	AI-0034	10/31/2012

Sincerely,

Sandra J. Moody

Sandra J. Moody, Environmental Technician
Division of Solid Waste Management
Bureau of Remediation and Waste Management

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD, SUITE 6
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04679-2094
(207) 764-0477 FAX: (207) 760-3143

web site: www.maine.gov/dep

Klane's **E**ducation **I**nformation **T**raining **H**ub℠

"Take a step in the right direction" ℠

491 Norridgewock Road
Fairfield, Maine 04937
(207) 453-KEITH (5348)
Fax (207) 453-5226
jonathan@trainerman.com
www.trainerman.com

Date: 10/12/11

Name: Dennis Kingman Jr.

Course abbreviation: AIR (also circle) Asbestos or Lead Initial or Refresher

Asbestos: Air Monitor, Inspector, Management Planner, Supervisor/OSHA CP, Worker, Designer, O&M/OSHA Class 3, OSHA Class 2 (Material: _____), Designated Person, Awareness, Other: _____

Lead: Renovator, Sampling Tech, Inspector, Risk Assessor, Supervisor/OSHA CP, Worker, Designer, Essential Maintenance, OSHA Worker, Awareness, Other: _____

Dear Dennis:

Congratulations on your successful completion of the above specified course. Your examination score was 96.

Your certificate is enclosed and the original should be kept in a safe place. You will need to give your employer a copy for their records which must be maintained for at least one year beyond your employment.

This training certification expires one year from the date of the exam (except for Lead Renovator is 5 years and Asbestos Designated Person has none), and you will need to take a Refresher course by then. We may (or may not) send you a reminder notice as a courtesy (but you need to keep track of this for yourself). Thank you for participating in the course and we hope to see you at future courses.

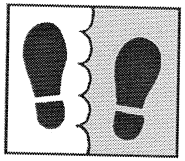
Sincerely,
Klane's Education Information Training Hub, LLC SM

Jonathan Klane, M.S.Ed., CIH, CHMM, CET

Enclosure

Klane's Education Information Training Hub℠

491 Norridgewock Road * Fairfield, Maine 04937 * (207) 453-KEITH (5348) * jonathan@trainerman.com * www.trainerman.com



SM

"Take a step in the right direction" SM

Certifies that

Dennis B. Kingman, Jr., CHMM

DOB or SSN: 10/09/1961

has attended and successfuly completed the required classroom and written examination under TSCA Title II and DEP Chapter 425 on October 17, 2011 for the

Asbestos Inspector 4-Hour Annual Refresher Training Course

* Refresher course is not valid without the corresponding initial and any required refresher training courses.

October 17, 2011

Exam Date

Jonathan Klane, M.S.Ed., CIH, CHMM, CET

October 17, 2012

Expiration Date

KAIR-348

Certificate Number

Klane's **E**ducation **I**nformation **T**raining **H**ub℠

"Take a step in the right direction" ℠

491 Norridgewock Road
Fairfield, Maine 04937
(207) 453-KEITH (5348)
Fax (207) 453-5226
jonathan@trainerman.com
www.trainerman.com

Date: 10/17/11

Name: Dennis Kingman

Course abbreviation: AMPR (also circle) (Asbestos) or Lead Initial or (Refresher)

Asbestos: Air Monitor, Inspector, (Management Planner), Supervisor/OSHA CP, Worker, Designer, O&M/OSHA Class 3, OSHA Class 2 (Material: _____), Designated Person, Awareness, Other: _____

Lead: Renovator, Sampling Tech, Inspector, Risk Assessor, Supervisor/OSHA CP, Worker, Designer, Essential Maintenance, OSHA Worker, Awareness, Other: _____

Dear Dennis:

Congratulations on your successful completion of the above specified course. Your examination score was 100.

Your certificate is enclosed and the original should be kept in a safe place. You will need to give your employer a copy for their records which must be maintained for at least one year beyond your employment.

This training certification expires one year from the date of the exam (except for Lead Renovator is 5 years and Asbestos Designated Person has none), and you will need to take a Refresher course by then. We may (or may not) send you a reminder notice as a courtesy (but you need to keep track of this for yourself). Thank you for participating in the course and we hope to see you at future courses.

Sincerely,
Klane's Education Information Training Hub, LLC SM

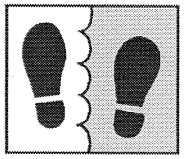
Jonathan Klane

Jonathan Klane, M.S.Ed., CIH, CHMM, CET

Enclosure

Klane's Education Information Training Hub℠

491 Norridgewock Road * Fairfield, Maine 04937 * (207) 453-KEITH (5348) * jonathan@trainerman.com * www.trainerman.com



SM

"Take a step in the right direction" SM

Certifies that

Dennis Kingman, Jr., CHMM

DOB or SSN: 10/09/1961

has attended and successfuly completed the required classroom and written examination under TSCA Title II and DEP Chapter 425 on October 17, 2011 for the

Asbestos Management Planner 4-Hour Annual Refresher Training Course

* Refresher course is not valid without the corresponding initial and any required refresher training courses.

October 17, 2011

Exam Date

Jonathan Klane, M.S.Ed., CIH, CHMM, CET

October 17, 2012

Expiration Date

KAMPR-149

Certificate Number

State of Maine

Asbestos Abatement Program

Brett M. Deyling

Inspector

Cert No. AI-0605

Trn.Exp.Date 04/22/2012

Expiration Date 04 30 2012

This is not a legal form of official identification

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAUL R. LEPAGE
GOVERNOR

DARRYL N. BROWN
COMMISSIONER

May 10, 2011

Summit Environmental Consultants, Inc.
640 Main Street
Lewiston, Maine 04240

Dear Licensee:

Asbestos application(s) for individual certification of the **one** employee(s) listed below have been received and **approved**. Individual certification numbers are listed below and wallet card(s) are enclosed. Card(s) are property of the individual to whom each is issued. Your responsibility as a licensee is to ensure delivery of the cards to persons in your employment. This letter should be retained for your company files as record of certification.

Remember, in Maine all **certified employees** working on an asbestos abatement project, whether conducting removal/repair, air monitoring, design, inspection, or analysis functions, **must work for a State of Maine licensed asbestos firm** and carry his/her wallet card(s) on the job site.

As a reminder, prior to renewing your asbestos certification, the State of Maine **requires** an annual refresher course to be taken before submitting a renewal application. A certificate shall expire one year from the last day of the month from the date of issuance, **or on the last day of the month that the training certificate expires**, whichever is sooner. A listing of training providers is attached and it is your responsibility to ensure you have completed a renewal training course prior to your training expiration date.

All our asbestos forms can be found at http://www.maine.gov/dep/rwm/asbestos/newupdatedformsasb.htm. Thank you for your cooperation and your completed application(s).

Name	Category	Certification #	Exp. Date
Brett M. Deyling	Inspector	AI-0605	04/30/2012

Sincerely,

Sandra J. Moody

Sandra J. Moody, Environmental Technician
Division of Solid Waste Management
Bureau of Remediation and Waste Management

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD, SUITE 6
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04679-2094
(207) 764-0477 FAX: (207) 760-3143

web site: www.maine.gov/dep

Environmental Management Inc.

51 River Road Brunswick, Maine 04011
(207) 729-7549

This is to certify that:

Brett Deyling

Has completed the requisite 4-hour refresher training, and has passed an examination for reaccreditation as an:

Asbestos Inspector

pursuant to Title II of the Toxic Substance Control Act, 15 U.S.C. 2646
and Maine State Regulations 06-096 CMR 425.5 (E)

January 27, 2012

1/27/2012	84	1/26/2013
Examination Date	***Test Score***	***Expiration Date***

	AI-R-TP0018-12-0293
President / Director of Training	***Certificate Number***

Appendix C

ASBESTOS ANALYTICAL LABORATORY CERTIFICATIONS

State of Maine

Department of Environmental Protection

LICENSE

EMSL Analytical, Inc.

Asbestos Analytical Laboratory

(Bulk)

License Number: LB-0039 **Expiration Date:** 10/31/2012

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

AIRBORNE ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2011-07-01 through 2012-06-30

Effective dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

Sally S. Bruce

For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Mr. Stephen Siegel, CIH
Phone: 800-220-3675 Fax: 856-786-5973
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

AIRBORNE ASBESTOS FIBER ANALYSIS (TEM) **NVLAP LAB CODE 101048-0**

NVLAP Code	*Designation / Description*
18/A02	U.S. EPA's "Interim Transmission Electron Microscopy Analytical Methods-Mandatory and Nonmandatory-and Mandatory Section to Determine Completion of Response Actions" as found in 40 CFR, Part 763, Subpart E, Appendix A.

2011-07-01 through 2012-06-30
Effective dates

Sally S. Bruce
For the National Institute of Standards and Technology

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101048-0

EMSL Analytical, Inc.

Cinnaminson, NJ

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2011-07-01 through 2012-06-30

Effective dates

DEPARTMENT OF COMMERCE * UNITED STATES OF AMERICA *

Sally S. Bruce

For the National Institute of Standards and Technology

NVLAP® National Voluntary Laboratory Accreditation Program

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
Mr. Stephen Siegel, CIH
Phone: 800-220-3675 Fax: 856-786-5973
E-Mail: ssiegel@emsl.com
URL: http://www.emsl.com

BULK ASBESTOS FIBER ANALYSIS (PLM) **NVLAP LAB CODE 101048-0**

NVLAP Code	*Designation / Description*
18/A01	EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2011-07-01 through 2012-06-30
Effective dates

For the National Institute of Standards and Technology

AIHA

Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

EMSL Analytical Inc.

200 Route 130 North, Cinnaminson, NJ 08077

Laboratory ID: 100194

has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC thereby conforming to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories.* The above named laboratory, along with all premises from which key activities are performed, as listed above, have been accredited by AIHA-LAP, LLC in the following:

LABORATORY ACCREDITATION PROGRAMS

√	**INDUSTRIAL HYGIENE**	Accreditation Expires: July 01, 2012
√	**ENVIRONMENTAL LEAD**	Accreditation Expires: July 01, 2012
√	**ENVIRONMENTAL MICROBIOLOGY**	Accreditation Expires: July 01, 2012
☐	**FOOD**	Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation.** Continued accreditation is contingent upon successful on-going compliance with AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation.** Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current scope of accreditation.

Dave Sandusky

Dave Sandusky, CIH
Chairperson, Analytical Accreditation Board

Date Issued: 07/01/2010

AIHA
Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC
SCOPE OF ACCREDITATION

EMSL Analytical, Inc.
107 Haddon Avenue, Westmont, NJ 08108

Laboratory ID: 100194
Issue Date: 07/01/2010

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or revocation. A complete listing of currently accredited Industrial Hygiene laboratories is available on the AIHA-LAP, LLC website at: http://www.aihaaccreditedlabs.org

Industrial Hygiene Laboratory Accreditation Program (IHLAP)

Initial Accreditation Date: 02/01/1989

IHLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Core Program Testing	Gas Chromatography	NIOSH 1003	
		NIOSH 1005	
		NIOSH 1400	
		NIOSH 1500	
		NIOSH 1550	
		NIOSH 1603	
		NIOSH 2000	
		NIOSH 2551	
		NIOSH 5502	
		NIOSH 5503	
		NIOSH 5510	
		OSHA 1010	
	GC (Diffusive Samplers)	NIOSH 1003	
		NIOSH 1005	
		NIOSH 1501	
	GC/MS	EPA TO-15	
	HPLC	NIOSH 2016	
		NIOSH 5506	
		OSHA 47	
		OSHA 58	
	AA	NIOSH 6009	
		NIOSH 7105	
		OSHA ID-140	
		OSHA ID-145	
	ICP	NIOSH 7300	
	XRD	NIOSH 7500	
	Ion Chromatography	NIOSH 6004	
		NIOSH 6011	
		NIOSH 7903	

AIHA
Laboratory Accreditation Programs, LLC

IHLAP Category	Field of Testing (FoT)	Method	Method Description *(for internal methods only)*
Core Program Testing	Ion Chromatography	OSHA ID-214	
		OSHA ID-215	
	Gravimetric	NIOSH 0500	
		NIOSH 0600	
	UV/VIS (Colorimetric)	NIOSH 6010	
	Thermal Optical Analyzer	NIOSH 5040	
	Polarized Light Microscopy (PLM)	EPA 600/R-93/116	
	Phase Contrast Microscopy (PCM)	NIOSH 7400	
	Transmission Electron Microscopy (TEM)	EPA AHERA - 40 CFR Part 763	
		NIOSH 7402	

The laboratory participates in the following AIHA-LAP, LLC-approved proficiency testing programs:

- ✓ Metals*
- ✓ Silica*
- ✓ Asbestos*
- ☐ Bulk Asbestos*
- ✓ Beryllium
- ✓ Organic Solvents*
- ✓ Diffusive Sampler (3M)*
- ☐ Diffusive Sampler (SKC)*
- ☐ Diffusive Sampler (AT)
- ✓ WASP[1] (Formaldehyde)
- ☐ WASP[1] (Thermal Desorption Tubes)
- ☐ Pharmaceutical Round Robin
- ☐ Compressed/Breathing Air Round Robin
- ☐ NVLAP (determined at the time of site assessment)

[1] Workplace Analytical Scheme for Proficiency

Appendix D

LEAD-BASED PAINT
DETERMINATION REPORT

AES

Atlantic Environmental Services
PO Box 615
West Kennebunk, Maine 04094
Phone: (207) 604-2581
Email: deb.atlanticenvironmental@gmail.com

Lead-Based Paint XRF TESTING

Cumberland County Civic Center Portland, Maine

Prepared For:

Mr. Dennis Kingman
Summit Environmental Consultants, Inc.
8 Harlow Street, Suite 4A
Bangor, Maine 04401

AES *Atlantic Environmental Services*
PO Box 615
West Kennebunk, Maine 04094

April 4, 2012

Dennis Kingman
Summit Environmental Consultants, Inc.
8 Harlow Street, Suite 4A
Bangor, Maine 04401

RE: Lead-Based Paint XRF Testing
Cumberland County Civic Center, Portland, Maine
AES Job #: 12-133

Dear Mr. Kingman:

Atlantic Environmental Services has completed the environmental lead-based paint testing at the Cumberland County Civic Center located in Portland, Maine.

Purpose

The purpose of this testing was to determine the presence of lead-based paint on components throughout the facility. The lead-based paint testing was performed utilizing a portable X-ray Fluorescence Analyzer (XRF) that non-destructively tests for the presence of lead on building components. Once lead-containing components were identified, a visual assessment as to the current condition of the paint was also performed.

Lead Testing Procedures

On March 15, 2012, I, Deborah A. Kasik, *ME DEP* certified Lead Risk Assessor, License #LR-0003, performed the Lead-Based Paint Testing.

The lead-based paint testing was performed in accordance with the *established protocols* outlined in the *State of Maine Department of Environmental Protection's* Lead Management Regulations, Chapter 424, Section 7, as they apply to this project. The testing provides information on the lead-based paint content and assessment of condition for the surfaces tested. All results have been included on the field forms for your review. *Important note: The room numbers/names correspond to those on the drawing produced by AES.*

The lead-based paint testing was conducted utilizing a portable X-ray Fluorescence Lead Paint Analyzer (RMD LPA-1), which non-destructively tests for the presence of lead-based paint. This equipment is licensed with the Department of Human Services Radiation Control Program and operated in accordance with all applicable regulations and conditions of licensure.

Explanation of Analysis Methods

The X-ray Fluorescence Lead Paint Analyzer is a complete lead paint analysis system that quickly, accurately, and non-destructively measures the concentration of lead-based paint on surfaces. X-ray Fluorescence is a common technique utilizing gamma rays to bombard the surface, causing the atoms in the paint to emit characteristic X-rays. These characteristic X-rays are detected and analyzed to provide the apparent lead concentration information.

The RMD LPA-1 has the ability to read concentrations of lead in paint up to 9.9 milligrams per square centimeter; if the content of lead in the paint is greater than 9.9, the reading for that component will be listed as >9.9 mg/cm^2. The minimum detection limit of this particular equipment is 0.3 milligrams per square centimeter.

Calibration of the equipment is required by regulation and, as indicated on the Field Sheets, the readings were within the limits established by the manufacturer.

Limitations

In certain circumstances, leaded components may be covered by other building components, such as sheetrock over old painted walls and ceilings. It should be understood that the lead testing process is non-destructive, unless authorization has been received by the Owner to access otherwise inaccessible components. Those areas where access was achievable, the surfaces were tested and the results included on the field forms. In cases where the components were inaccessible, the Owner can either assume that these inaccessible components contain lead-based paint or have them tested when renovation work may disturb them. The XRF readings obtained on the accessible surface are therefore for that surface only (i.e. XRF reading on paneling) and do not apply to the surface beneath it.

Observations/Results

Cumberland County Civic Center is a multi-level, multi-purpose concrete building located in Portland, Maine. A limited amount of lead was identified in the building, as outlined below:

Interior:

Ladies Rooms – Entry walls only (previously marked with 'arrows' or insignia)
Each wall area is approximately 4'x4' in size
Arena Area – Large 'Row' lettering on the cinderblock walls around the perimeter of the arena
Painted either in black or in orange
Utility Closets – Glazing on utility sinks only
Admin/Office Areas – vinyl baseboards

Exterior:

No lead-based paint identified

The condition of the paint both interior and exterior ranges from good to poor as indicated on the field forms (good – fair=highlighted in blue; poor=highlighted in yellow. **Similar components to the ones tested should be presumed to yield the same results**.

Explanation of Results

Components found to contain lead-based paint have also been assessed in terms of the condition of the paint. This assessment is based on the definitions outlined in the DEP regulations and utilized as an industry standard. There are three different classifications for paint condition - good, fair, and poor, which are 'generally' defined as follows:

- GOOD: paint which is entirely intact.
- FAIR: paint is intact, but worn; minor chips are evident as a result of normal wear and tear; no adhesion or substrate problems, e.g. no broken wallboard is present.
- POOR: paint is severely worn, weathered, or no longer adhering, i.e. peeling, cracking, flaking, chalking; or the substrate is broken, exposed, or otherwise deteriorated.

Recommendations

The objective of this testing was to determine the presence of lead-based paint and assess the condition of the paint as it currently exists. All scraping, sanding, cutting, welding, grinding, or demolition of any painted surface should not be performed under dry conditions in which airborne dust can be generated. Similarly, renovation/demolition activities that may impact lead-containing components are a concern with respect to the

generation of airborne lead dust; therefore, safety measures such as the use of engineering controls are essential in order to protect human health and the environment. Contractors performing renovation/demolition activities in which excessive amounts of lead dust may be generated shall be trained in the hazards of lead-containing materials and the subsequent removal, cleaning, packaging, and handling of these materials as well as wearing NIOSH approved respirators, disposable clothing, and other requirements of the standard. All work operations shall be performed in accordance with the following:

- *OSHA 29 CFR Part 1926.62, Lead Standard*.

The lead dust generated from any renovation work must be contained so that exposure is minimal, for both the workers and any occupants. After any renovation work is completed the dust should immediately be cleaned in order to prevent migration to other areas of the structure or waterway.

Monitoring lead-containing components that remain for condition changes is important; any changes should be addressed immediately. Any work, whether it is on the interior or exterior of the structure should be performed in a safe manner so as to minimize the amount of dust that is generated.

Additional recommendation: when ordering building materials for renovation/rehabilitation projects, order should state 'Lead-Free'.

If you should have any questions at all concerning the information contained herein, or in general, please do not hesitate to contact me at (207) 604-2581 or via email at deb.atlanticenvironmental@gmail.com .

Sincerely,

Deborah A. Kasik

Deborah A. Kasik
Lead Risk Assessor (LR#0003)

Enclosures

ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	1 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-1	SECTION K LOBBY	A	STRUCTURAL I-BEAMS	WHITE	METAL	<0.3		
L-2	SECTION K LOBBY	A	WALL	WHITE	CONCRETE	<0.3		
L-3	SECTION K LOBBY	D	ENTRY DOORS	FACTORY	METAL	<0.3		
L-4	SECTION K LOBBY	C	WINDOWS	BROWN	METAL	<0.3		
L-5	SECTION K LOBBY	C	RAIL ALONG WINDOW	STAIN	WOOD	<0.3		
L-6	SECTION K LOBBY	A	ENTRY DOORS	BLUE	METAL	<0.3		
L-7	SECTION K LOBBY	A	ENTRY DOOR FRAMES	BLUE	METAL	<0.3		
L-8	SECTION K LOBBY	A	FIRE EXTINGUISHER SUPPORT	RED	METAL	<0.3		
L-9	SECTION K LOBBY	B	ARROW TO MEN'S	GREEN	CONCRETE	<0.3		
L-10	SECTION D,E,F MEN'S	C	MEN'S ROOM WALL	BLUE	CONCRETE	<0.3		
L-11	SECTION D,E,F MEN'S	C	MEN'S ROOM FLOOR	GRAY	CONCRETE	<0.3		
L-12	SECTION D,E,F MEN'S	C	CEILING BEAM	WHITE	CONCRETE	<0.3		
L-13	SECTION D,E,F MEN'S	C	CEILING BEAM	WHITE	CONCRETE	<0.3		
L-14	SECTION D,E,F MEN'S	C	STALLS		METAL	<0.3		
L-15	SECTION D,E,F MEN'S	C	CLOSET WALLS	WHITE	CONCRETE	<0.3		
L-16	SECTION D,E,F MEN'S	C	CLOSET CEILING	WHITE	CONCRETE	<0.3		
L-17	SECTION D,E,F MEN'S	C	CLOSET FLOOR	RED & GRAY	CONCRETE	<0.3		
L-18	SECTION D,E,F MEN'S	C	CLOSET DOOR / FRAME	BROWN	METAL	<0.3		
L-19	SECTION D,E,F MEN'S	C	JANITOR'S SINK	GLAZE	CERAMIC	>9.9		
L-20	SECTION D,E,F MEN'S	C	REGULAR SINKS	GLAZE	CERAMIC	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	2 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-21	SECTION D,E,F LADIES	C	ARROW TO LADIES	BLUE	CONCRETE	<0.3		
L-22	SECTION D,E,F LADIES	C	WALLS AT ENTRY	PINK	CONCRETE	0.8 / 0.9 / 1.3 / 1.4 / 2.9	G	
L-23	SECTION D,E,F LADIES	C	WALLS	PINK	CONCRETE	<0.3		
L-24	SECTION D,E,F LADIES	C	CEILING	WHITE	CONCRETE	<0.3		
L-25	SECTION D,E,F LADIES	C	CEILING BEAM	WHITE	CONCRETE	<0.3		
L-26	SECTION D,E,F LADIES	C	FLOOR	GRAY	CONCRETE	<0.3		
L-27	B,C,D LOBBY AREA	C	SPRINKLER PIPING	FACTORY	METAL	<0.3		
L-28	B,C,D LOBBY AREA	C	WALLS	WHITE	CONCRETE	<0.3		
L-29	B,C,D LOBBY AREA	C	DOOR / FRAME	BROWN	METAL	<0.3 / <0.3		
L-30	B,C,D LOBBY AREA	A	STRUCTURAL I-BEAM	WHITE	METAL	<0.3		
L-31	'B' STAIRS TO CENTER	B,C	DOOR / FRAMES	BROWN	METAL	<0.3 / <0.3		
L-32	'B' STAIRS TO CENTER		STRUCTURAL I-BEAM*	BROWN	METAL	<0.3		* ABOVE DOOR
L-33	'B' STAIRS TO CENTER		STRUCTURAL I-BEAM	WHITE	METAL	<0.3		
L-34	'B' STAIRS TO CENTER		DOOR / FRAME TO PRIVATE OFFICE	BROWN	METAL	<0.3		
L-35	'B' STAIRS TO CENTER	B	ELEVATOR DOORS	GREEN	METAL	<0.3		
L-36	'B' STAIRS TO CENTER		HANDRAIL TO UPPER LEVELS	BROWN	METAL	<0.3		
L-37	'B' STAIRS TO CENTER	D	DOORS / FRAME	BLUE	METAL	<0.3		
L-38	'B' STAIRS TO CENTER	C	ACCESS DOOR	BROWN	METAL	<0.3		
L-39	W,X,Y LOBBY AREA	A	STRUCTURAL I-BEAMS	BROWN / WHITE	METAL	<0.3 / <0.3		
L-40	W,X,Y LOBBY AREA	C	WALLS	WHITE	CONCRETE	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	3 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-41	W,X,Y LOBBY AREA	C	DOORS / FRAME	BLUE	METAL	<0.3		
L-42	SECTION WXY MEN'S	A	WALLS	BLUE	CONCRETE	<0.3 / <0.3		
L-43	SECTION WXY MEN'S	A	FLOOR	GRAY	CONCRETE	<0.3		
L-44	SECTION WXY MEN'S	A	CEILING & CEILING BEAM	WHITE	CONCRETE	< 0.3 / <0.3		
L-45	SECTION WXY MEN'S	A	HEATER	BROWN	METAL	<0.3		
L-46	SECTION WXY MEN'S	A	UTILITY CLOSET	BROWN	METAL	<0.3		
L-47	SECTION WXY LADIES	A	WALLS AT ENTRY	PINK	CONCRETE	0.7 / 0.8 / 0.6 / 0.7 / 1.0	G	
L-48	SECTION WXY LADIES	A	FLOOR	GRAY	CONCRETE	<0.3		
L-49	SECTION WXY LADIES	A	CEILING & CEILING BEAM	WHITE	CONCRETE	<0.3 / <0.3		
L-50	S,T,U LOBBY AREA	C	GRATE	FACTORY	METAL	<0.3		
L-51	S,T,U LOBBY AREA	C	WALLS	WHITE	CONCRETE	<0.3		
L-52	S,T,U LOBBY AREA	A	DOOR / FRAME	BROWN	METAL	<0.3		
L-53	S,T,U LOBBY AREA	C	STRUCTURAL I-BEAM		METAL	<0.3		
L-54	ARENA AREA		PIPING	ORANGE	METAL	<0.3		
L-55	L,M,N,O LOBBY AREA		PIPING	BLUE	METAL	<0.3		
L-56	L,M,N,O LOBBY AREA		WALLS	BLUE	WOOD	<0.3		
L-57	L,M,N,O LOBBY AREA		SAFETY MARKINGS	YELLOW	CONCRETE	<0.3 / <0.3		ALONG STAIRS
L-58	L,M,N,O LOBBY AREA		SEATS	GREEN	METAL	<0.3		
L-59	L,M,N,O LOBBY AREA		SEATS	BLUE	METAL	<0.3		
L-60	L,M,N,O LOBBY AREA		SEATS	BLACK	METAL	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	4 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-61	L,M,N,O LOBBY AREA		LADDER TO CATWALK	YELLOW	METAL	<0.3		
L-62	L,M,N,O LOBBY AREA		STRUCTURAL STEEL	CREAM	METAL	<0.3 / <0.3 / <0.3 / <0.3		
L-63	L,M,N,O LOBBY AREA		WALLS	CREAM	WOOD	<0.3		
L-64	L,M,N,O LOBBY AREA		LMNO LETTERS * (INCLUDES ALL LETTERS	BLACK	PAINT ON CONCRETE	6.2 / 6.5	G	* ON BARE CINDERBLOCK WALLS AROUND ARENA
L-65	B,C,D,E,F,G,H AREA		PIPING	YELLOW	METAL	<0.3		
L-66	B,C,D,E,F,G,H AREA		PIPING	GREEN	METAL	<0.3		
L-67	B,C,D,E,F,G,H AREA		PIPING	BLUE	METAL	<0.3		
L-68	B,C,D,E,F,G,H AREA		WALLS	BLUE	WOOD	<0.3		
L-69	B,C,D,E,F,G,H AREA		ROW NUMBERS	BLACK	CONCRETE	<0.3		ROW NUMBERS ON STAIRS
L-70	B,C,D,E,F,G,H AREA		SUPPORTS ON STAIRS	WHITE	METAL	<0.3		
L-71	B,C,D,E,F,G,H AREA		LADDER TO CATWALK	YELLOW	METAL	<0.3		
L-72	B,C,D,E,F,G,H AREA		BCDEFGH LETTERS*	YELLOW	PAINT ON CONCRETE	>9.9	G	* ON BARE CONCRETE
L-73	B,C,D,E,F,G,H AREA		STRUCTURAL STEEL	WHITE	WOOD	<0.3		
L-74	B,C,D,E,F,G,H AREA		WALLS	MULTI	WOOD	<0.3		
L-75	B,C,D,E,F,G,H AREA		CATWALK FRAME	CREAM	METAL	<0.3		
L-76	B,C,D,E,F,G,H AREA		BOOTH DOOR / FRAME	BLACK	METAL	<0.3		
L-77	B,C,D,E,F,G,H AREA		PIPING	GREEN	METAL	<0.3		
L-78	B,C,D,E,F,G,H AREA		PIPING	YELLOW	METAL	<0.3		
L-79	B,C,D,E,F,G,H AREA		PIPING	BLUE	METAL	<0.3		
L-80	B,C,D,E,F,G,H AREA		PIPING	ORANGE	METAL	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	5 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-81	B,C,D,E,F,G,H AREA		SAFETY PRINT	YELLOW	CONCRETE	<0.3		
L-82	B,C,D,E,F,G,H AREA		LETTERS IF	ORANGE	CONCRETE	8.8		
L-83	B,C,D,E,F,G,H AREA		WALL AROUND IT	BLUE	CONCRETE	<0.3		
L-84	B,C,D,E,F,G,H AREA		STRUCTURAL STEEL	CREAM	METAL	<0.3		X ALL
L-85	B,C,D,E,F,G,H LOWER		BOX AREA	WHITE	CONCRETE	<0.3		
L-86	B,C,D,E,F,G,H LOWER		RAIL	BROWN	METAL	<0.3		
L-87	B,C,D,E,F,G,H LOWER		RAIL SUPPORT	BLACK	METAL	<0.3		
L-88	B,C,D,E,F,G,H LOWER		WALLS	BLACK	CONCRETE	<0.3		
L-89	R,S,T,U,V,W,X,Y,Z AREA		SAFETY	YELLOW	CONCRETE	<0.3		
L-90	R,S,T,U,V,W,X,Y,Z AREA		KNEE WALL	BLACK / WHITE	FIBERGLASS	<0.3		
L-91	R,S,T,U,V,W,X,Y,Z AREA		BASEBOARD	YELLOW	FIBERGLASS	<0.3		
L-92	MAIN LOBBY		WALLS	WHITE	CONCRETE	<0.3 / <0.3		
L-93	TICKET AREA		STRUCTURAL SUPPORTS	WHITE	METAL	<0.3		
L-94	TICKET AREA		CEILING	WHITE	CONCRETE	<0.3		
L-95	TICKET AREA		SUPPORT COLUMNS	WHITE	CONCRETE	<0.3		
L-96	TICKET AREA		STRUCTURAL SUPPORTS	BROWN	METAL	<0.3		
L-97	TICKET AREA		ROLL UP DOORS / FRAME	BROWN	METAL	<0.3 / <0.3		
L-98	LOBBY PUB & GRILL		HANDRAIL	BROWN	METAL	<0.3		
L-99	LOBBY PUB & GRILL		UPPER WALL	WHITE	DRYWALL	<0.3		
L-100	LOBBY PUB & GRILL		CHAIR RAIL	N/A	PLASTIC	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	6 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-101	LOBBY PUB & GRILL		LOWER WALL	N/A	DRYWALL	<0.3		
L-102	LOBBY PUB & GRILL		BASEBOARD	GRAY	VINYL	<0.3		
L-103	LOBBY PUB & GRILL		ENTRY DOORS & FRAMES	BLUE	METAL	<0.3 / <0.3		
L-104	ENTRY TO KITCHEN / EXTERIOR		WALLS	WHITE	CONCRETE	<0.3		
L-105	ENTRY TO KITCHEN / EXTERIOR		BASEBOARD	GRAY	CONCRETE	<0.3		
L-106	ADMIN TICKET AREA		WALLS	CREAM	CONCRETE	<0.3		
L-107	ADMIN TICKET AREA		BASEBOARD	GRAY	VINYL	3.4	G	
L-108	ADMIN TICKET AREA		WALLS	PINK	WOOD	<0.3		
L-109	ADMIN TICKET AREA		WALLS	CREAM	WOOD	<0.3		
L-110	OFFICE		WALLS	CREAM	DRYWALL	<0.3		
L-111	OFFICE		BASEBOARD	CREAM	VINYL	2.3	G	
L-112	OFFICE		VAULT DOOR & FRAME	CREAM	METAL	<0.3 / <0.3		
L-113	BATHROOM		CEILING	WHITE	DRYWALL	<0.3		
L-114	BATHROOM		WALLS	N/A	CONCRETE	<0.3		
L-115	BATHROOM		HEATER	N/A	METAL	<0.3		
L-116	BATHROOM		BASEBOARD	GRAY	VINYL	<0.3		
L-117	OFFICE TO OFFICE		DOOR TRIM	CREAM	WOOD	<0.3		
L-118	OFFICE TO OFFICE		DOOR THRESHOLD	STAIN	WOOD	<0.3		
L-119	OFFICE		WALLS	BLUE	DRYWALL	<0.3		
L-120	OFFICE BEHIND RECEPTION		WALLS	WALLPAPER	DRYWALL	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	7 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-121	OFFICE BEHIND RECEPTION		BASEBOARD		VINYL	<0.3		
L-122	OFFICE BEHIND RECEPTION		DOOR / TRIM		METAL	<0.3		
L-123	GENERAL GM'S		WALLS	WALLPAPER	DRYWALL	<0.3		
L-124	OFFICE GM'S		CEILING	WHITE	CONCRETE	0.4		
L-125	LOWER LEVEL OFFICE CORNER		UPPER WALLS	WHITE	CONCRETE	<0.3		
L-126	LOWER LEVEL OFFICE CORNER		LOWER WALLS	GRAY	CONCRETE	<0.3		
L-127	LOWER LEVEL OFFICE CORNER		SHELF RACK	BLACK	WOOD	<0.3		
L-128	LOWER LEVEL OFFICE CORNER		SUPPORTS	WHITE / GRAY	METAL	<0.3		
L-129	LOWER LEVEL OFFICE CORNER		BRICK ABOVE DOOR	WHITE	BRICK	<0.3		
L-130	LOWER LEVEL OFFICE CORNER		DOOR / FRAME	BLACK	METAL	<0.3		
L-131	LOWER LEVEL OFFICE CORNER		CEILING & CEILING BEAM	WHITE	CONCRETE	<0.3		
L-132	STAGE HANDS ONLY OFFICE		WALLS	WHITE	CONCRETE	<0.3		
L-133	STAGE HANDS ONLY OFFICE		DOOR / FRAME	BLACK	METAL	<0.3		
L-134	UTILITY ROOM		FLOOR	RED	CONCRETE	<0.3		
L-135	UTILITY ROOM		WALLS	GRAY & WHITE	CONCRETE	<0.3 / <0.3		
L-136	UTILITY ROOM		DOOR / FRAME	BROWN	METAL	<0.3		
L-137	SHOP		SUPPORT COLUMN	WHITE	CONCRETE	<0.3		
L-138	SHOP		CEILING & CEILING BEAM	WHITE	CONCRETE	<0.3 / <0.3		
L-139	SHOP		CORNER	N/A	METAL	<0.3		
L-140	ANNEX	C	UPPER & LOWER WALLS	WHITE / GRAY	CONCRETE	<0.3 / <0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	8 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	*Deborah A. Kasik/LR#0003*

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-141	ANNEX		CORNER	N/A	METAL	<0.3		
L-142	ANNEX		ROLLING DOOR FRAME	BLACK	METAL	<0.3 / <0.3		
L-143	OPERATIONS DEPARTMENT		UPPER & LOWER WALLS	WHITE /GRAY	CONCRETE	<0.3 / <0.3		
L-144	OPERATIONS DEPARTMENT		DOOR / FRAME	N/A	METAL	<0.3		
L-145	OPERATIONS DEPARTMENT		WINDOW FRAME	N/A	METAL	<0.3		
L-146	OPERATIONS OFFICE SMALL		WALL	LIGHT GREEN	DRYWALL	<0.3		
L-147	OPERATIONS OFFICE SMALL		WALL	LIGHT GREEN	CONCRETE	<0.3		
L-148	OPERATIONS OFFICE SMALL		FLOOR	TILE	CERAMIC	<0.3		
L-149	OPERATIONS OFFICE LARGE		WALLS	GREEN	DRYWALL & WOOD	<0.3 / <0.3		
L-150	OPERATIONS OFFICE LARGE		DOOR TRIM	GREEN	WOOD	<0.3		
L-151	EMPLOYEE AREA BATHROOM		CEILING	WHITE	CONCRETE	<0.3		
L-152	EMPLOYEE AREA BATHROOM		WALLS	CREAM	CONCRETE	<0.3		
L-153	EMPLOYEE AREA BATHROOM		DOORS & FRAME	BROWN	METAL	<0.3		
L-154	EMPLOYEE AREA BATHROOM		THRESHOLD	GRAY	CONCRETE	<0.3		
L-155	BREAK ROOM		WALLS	WHITE	CONCRETE	<0.3		
L-156	BREAK ROOM		WINDOW TRIM	GREEN	METAL	<0.3		
L-157	BREAK ROOM		WALLS	WHITE	DRYWALL	<0.3		
L-158	BREAK ROOM		SUPPORT COLUMN	GREEN	CONCRETE	<0.3		
L-159	BREAK ROOM		CEILING	WHITE	CONCRETE	<0.3		
L-160	BREAK ROOM		DOOR	GREEN	WOOD	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	9 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	Deborah A. Kasik/LR#0003

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-161	HALLWAY TO UTILITY		WALLS	WHITE	CONCRETE	<0.3		
L-162	HALLWAY TO UTILITY		FLOOR	GRAY	CONCRETE	<0.3		
L-163	HALLWAY TO UTILITY		BASEBOARD	GRAY	CONCRETE	<0.3		
L-164	HALLWAY TO UTILITY		DOOR / FRAME	GREEN	METAL	<0.3 / <0.3		
L-165	HALLWAY TO UTILITY		UTILITY SINK	GLAZE	CERAMIC	>9.9		
L-166	HALLWAY TO UTILITY		SHELF / SHELF SUPPORTS	WHITE	WOOD	<0.3 / <0.3		
L-167	HALLWAY TO UTILITY		CEILING & CEILING BEAM	WHITE	CONCRETE	<0.3		
L-168	OFFICES		WALLS	CREAM	CONCRETE	<0.3 / <0.3		
L-169	OFFICES		DOORS / TRIM	GREEN	METAL	<0.3 / <0.3		
L-170	HALL TO PIRATES LOCKER ROOMS		CEILING	WHITE	CONCRETE	<0.3		
L-171	HALL TO PIRATES LOCKER ROOMS		WALLS	*	CONCRETE	<0.3		* WHITE, BLUE, RED, GRAY
L-172	RM. #1		CEILING	WHITE	CONCRETE	<0.3		
L-173	RM. #1		WALLS	WHITE	CONCRETE	<0.3		
L-174	RM. #1		VENT SYSTEM	WHITE	METAL	<0.3		
L-175	RM. #1		SUPPORT	WHITE	WOOD	<0.3		
L-176	SHOWER		TILE IN SHOWER	N/A	CERAMIC	<0.3		
L-177	SHOWER		BASEBOARD	& RED	VINYL	<0.3		
L-178	RM. #2		BASEBOARD	RED	METAL	<0.3		
L-179	RM. #3		WALLS	WHITE	CONCRETE	<0.3		
L-180	RM. #3		SHOWER ROOM FLOOR	GRAY	CONCRETE	<0.3		

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ENVIRONMENTAL LEAD-BASED XRF RESULTS

CLIENT:	Summit Environmental Consultants, Inc.	**DATE:**	3/15/2012
SITE:	Cumberland County Civic Center, Portland, Maine	**AES #:**	12-133
BLDG:		**Page:**	10 of 10
XRF #	D LPA-1 #3305; ME Rad Lic #31223 **CALIBRATION:** 1.0 / 1.0 mg/cm2	**Inspector Signature:**	Deborah A. Kasik/LR#0003

FIELD ID #	SAMPLE LOCATION	SIDE	COMPONENT(S)	COLOR	SUBSTRATE TYPE:	RESULTS mg/cm²	CONDITION	NOTES:
L-181	RM. #3		CEILING & CEILING BEAM	WHITE	CONCRETE	<0.3 / <0.3		
L-182	RM. #3		WALLS	WHITE	WOOD	<0.3		
L-183	RM. #3		WINDOW TRIM	N/A	WOOD	<0.3 / <0.3		
L-184	RM. #3		TREADS & RISERS TO UPPER LEVEL	N/A	WOOD	<0.3 / <0.3		
L-185	RM. #3		BASEBOARD	BLACK	VINYL	<0.3		
L-186	SPRING STREET LOBBY		WALLS	*	CONCRETE	<0.3		* BLACK, WHITE, RED, BLUE, GRAY
L-187	SPRING STREET LOBBY		WOOD TRIM	WHITE	WOOD	<0.3		
L-188	BOILER ROOM		UTILITY SINK	GLAZE	CERAMIC	>9.9		
L-189	BOILER ROOM		SPRINKLER PIPING	WHITE	METAL	<0.3		
L-190	BOILER ROOM		SPRINKLER PIPING	RED	METAL	<0.3		

D = Drywall; P = Plaster; W = Wood; M = Metal; C = Concrete; B = Brick; V = Vinyl. MG/CM² = Milligrams per square centimeter

Appendix E

PCB LABORATORY ANALYTICAL RESULTS

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800-929-9906
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April 3, 2012

Mr. Dennis Kingman
Summitt Environmental
8 Harlow St. Suite 4A
Bangor, ME 04401

RE: Analytical Results Case Narrative
Analytics # 72374
Cumberland County Civic Center
Project No: 12-3051

Dear Mr. Kingman;

Enclosed please find the analytical results for samples submitted for the above-mentioned project. The attached Cover Page lists the sample IDs, Lab tracking numbers and collection dates for the samples included in this deliverable.

Samples were analyzed for Polychlorinated Biphenyls (PCBs) by EPA Method 8082.

Unless otherwise noted in the Non-conformance Summary listed below, all of the quality control (QC) criteria including initial calibration, calibration verification, surrogate recovery, holding time and method accuracy/precision for these analyses were within acceptable limits.

This Level II data package has been assembled in the following order:

Case Narrative/Non-Conformance Summary
Sample Log Sheet - Cover Page
PCB Form 1 Data Sheet for Samples and Blanks
Chromatograms
PCB Form 10 Confirmation Results
PCB Form 3 MS/MSD (LCS) Recoveries
Chain of Custody (COC) Forms

QC NON CONFORMANCE SUMMARY

Sample Receipt:
No exceptions.

PCBs by EPA Method 8082:
No results were reported below the quantitation limit.

All samples were analyzed at increased quanitation limits due to sample matrix.

Samples 72374-3, 72374-7, 72374-9 and 72374-10 MS and MSD had interferences that prevented the determination of surrogate Decachlorobiphenyl on one or both columns. For samples were the interference was resent on both columns results were reported with a comment to that affect.

The MS/MSD analyzed on sample 72374-10 had high RPDs. The laboratory control samples (L032012PSOX/LD032012PSOX) were in control for all analytes. Results were reported without qualification.

The closing continuing calibration standard (file#L29155SC &L29156SC) had low recovery for surrogate Decachlorobiphenyl. The analytical window was re-analyzed with similar results. Results were reported without qualification.

If you have any questions on this data submittal, please do not hesitate to contact me.

Sincerely,
ANALYTICS Environmental Laboratory, LLC

Stephen Knollmeyer
Laboratory Director

analytics environmental laboratory LLC

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Mr. Dennis Kingman
Summit Environmental
8 Harlow St. Suite 4A
Bangor ME 04401

Report Number: 72374

Revision: Rev. 0

Re: Cumberland County Civic Center (Project No: 12-3051)

Enclosed are the results of the analyses on your sample(s). Samples were received on 20 March 2012 and analyzed for the tests listed. Samples were received in acceptable condition, with the exceptions noted below or on the chain of custody. These results pertain to samples as received by the laboratory and for the analytical tests requested on the chain of custody. The results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report. Please see individual reports for specific methodologies and references.

Sample Analysis: The attached pages detail the Client Sample IDs, Lab Sample IDs, and Analyses requested

Sample Receipt Exceptions: None

Analytics Environmental Laboratory is certified by the states of New Hampshire, Maine, Massachusetts, Connecticut, Rhode Island, Virginia, Maryland, North Carolina, and is accredited by the Deparment of Defense (DOD) ELAP program. A list of actual certified parameters is available upon request.

If you have any questions on these results, please do not hesitate to contact us.

Authorized signature _____
Stephen L. Knollmeyer Lab. Director

Date 4/3/2012

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CLIENT: Summit Environmental **REPORT NUMBER: 72374** **REV: Rev. 0**

PROJECT: Cumberland County Civic Center (Project No: 12-3051)

Lab Number	Sample Date	Station Location	Analysis	Comments
72374-1	03/15/12	NW3-1	EPA 8082 (PCBs only)	
72374-2	03/15/12	NW3-2	EPA 8082 (PCBs only)	
72374-3	03/15/12	NW3-3	EPA 8082 (PCBs only)	
72374-4	03/15/12	SW3-4	EPA 8082 (PCBs only)	
72374-5	03/15/12	SW3-5	EPA 8082 (PCBs only)	
72374-6	03/15/12	ND-1	EPA 8082 (PCBs only)	
72374-7	03/15/12	ND-2	EPA 8082 (PCBs only)	
72374-8	03/15/12	ED-3	EPA 8082 (PCBs only)	
72374-9	03/15/12	SD-4	EPA 8082 (PCBs only)	
72374-10	03/15/12	SD-5	EPA 8082 (PCBs only)	

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Surrogate Compound Limits

Matrix: / Units:	Aqueous % Recovery	Solid % Recovery	Method
Volatile Organic Compounds - Drinking Water			
1,4-Difluorobenzene	70-130		EPA 524.2
Bromofluorobenzene	70-130		
1,2-Dichlorobenzene-d4	70-130		
Volatile Organic Compounds			
1,2-Dichloroethane-d4	70-120	70-120	EPA 624/8260B
Toluene-d8	85-120	85-120	
Bromofluorobenzene	75-120	75-120	
Semi-Volatile Organic Compounds			
2-Fluorophenol	20-110	35-105	EPA 625/8270C
d5-Phenol	15-110	40-100	
d5-nitrobenzene	40-110	35-100	
2-Fluorobiphenyl	50-110	45-105	
2,4,6-Tribromophenol	40-110	40-125	
d14-p-terphenyl	50-130	30-125	
PAH's by SIM			
d5-nitrobenzene	21-110	35-110	EPA 8270C
2-Fluorobiphenyl	36-121	45-105	
d14-p-terphenyl	33-141	30-125	
Pesticides and PCBs			
2,4,5,6-Tetrachloro-m-xylene (TCX)	46-122	40-130	EPA 608/8082
Decachlorobiphenyl (DCB)	40-135	40-130	
Herbicides			
Dichloroacetic acid (DCAA)	30-150	30-150	
Gasoline Range Organics/TPH Gasoline			
Trifluorotoluene TFT (FID)	60-140	60-140	MEDEP 4217/EPA 8015
Bromofluorobenzene (BFB) (FID)	60-140	60-140	
Trifluorotoluene TFT (PID)	60-140	60-140	
Bromofluorobenzene (BFB) (PID)	60-140	60-140	
Diesel Range Organics/TPH Diesel			
m-terphenyl	60-140	60-140	MEDEP 4125/EPA 8015/CT ETPH
Volatile Petroleum Hydrocarbons			
2,5-Dibromotoluene (PID)	70-130	70-130	MADEP VPH May 2004 Rev1.1
2,5-Dibromotoluene (FID)	70-130	70-130	
Extracatable Petroleum Hydrocarbons			
1-chloro-octadecane (aliphatic)	40-140	40-140	MADEP EPH May 2004 Rev1.1
o-Terphenyl (aromatic)	40-140	40-140	
2-Fluorobiphenyl (Fractionation)	40-140	40-140	
2-Bromonaphthalene (fractionation)	40-140	40-140	

PCB
DATA SUMMARIES

analytics environmental laboratory LLC

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Mr. Dennis Kingman
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8 Harlow St. Suite 4A
Bangor ME 04401

April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: Lab QC

SAMPLE DATA

Lab Sample ID: B032012PSOX RR
Matrix: Soil
Percent Solid: 100
Dilution Factor: 1.0
Collection Date:
Lab Receipt Date:
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	33	U
PCB-1221	33	U
PCB-1232	33	U
PCB-1242	33	U
PCB-1248	33	U
PCB-1254	33	U
PCB-1260	33	U

Surrogate Standard Recovery

2,4;5,6-Tetrachloro-m-xylene	75	%
Decachlorobiphenyl	100	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

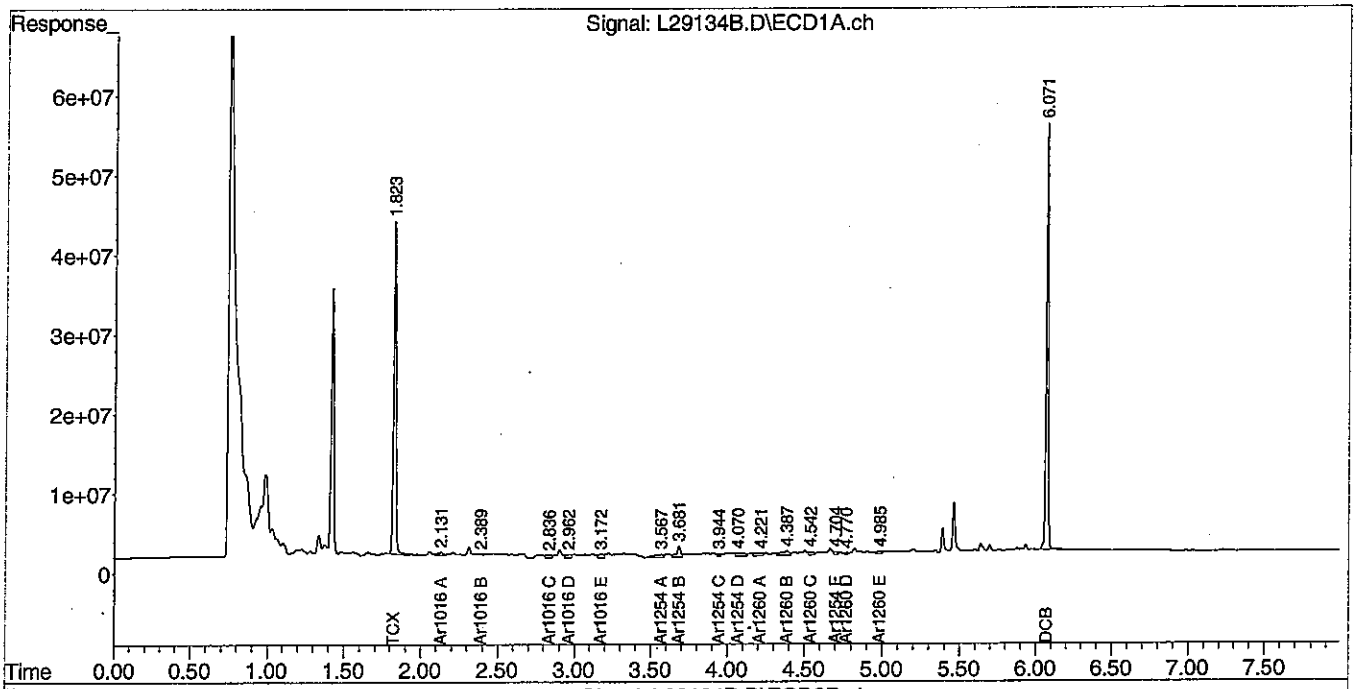
PCB Report

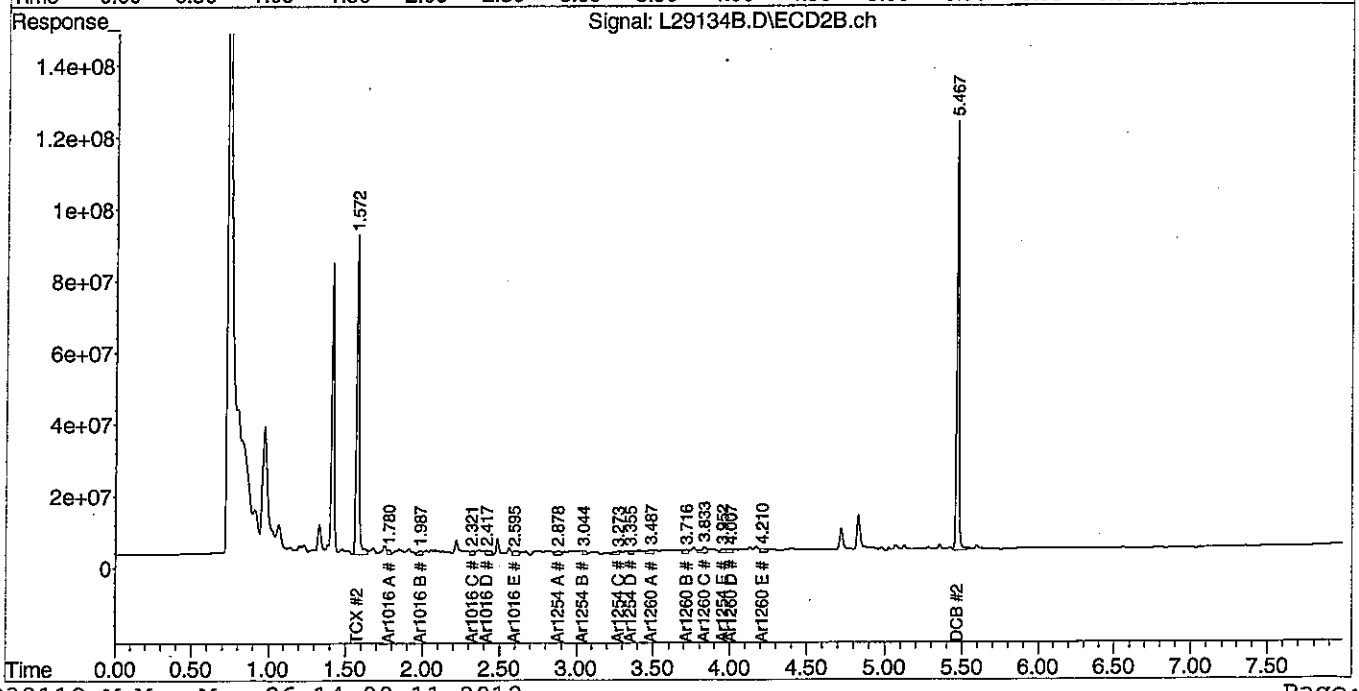
Authorized signature

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29134B.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 5:22 pm
Operator : JK
Sample : B032012PSOX,RR,,A/C
Misc : SOIL
ALS Vial : 6 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Mar 26 14:08:40 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um





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8 Harlow St. Suite 4A
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April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: NW3-1

SAMPLE DATA

Lab Sample ID: 72374-1
Matrix: Solid
Percent Solid: 100
Dilution Factor: 10
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	330	U
PCB-1221	330	U
PCB-1232	330	U
PCB-1242	330	U
PCB-1248	330	U
PCB-1254	330	U
PCB-1260	330	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	79	%
Decachlorobiphenyl	60	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

PCB Report

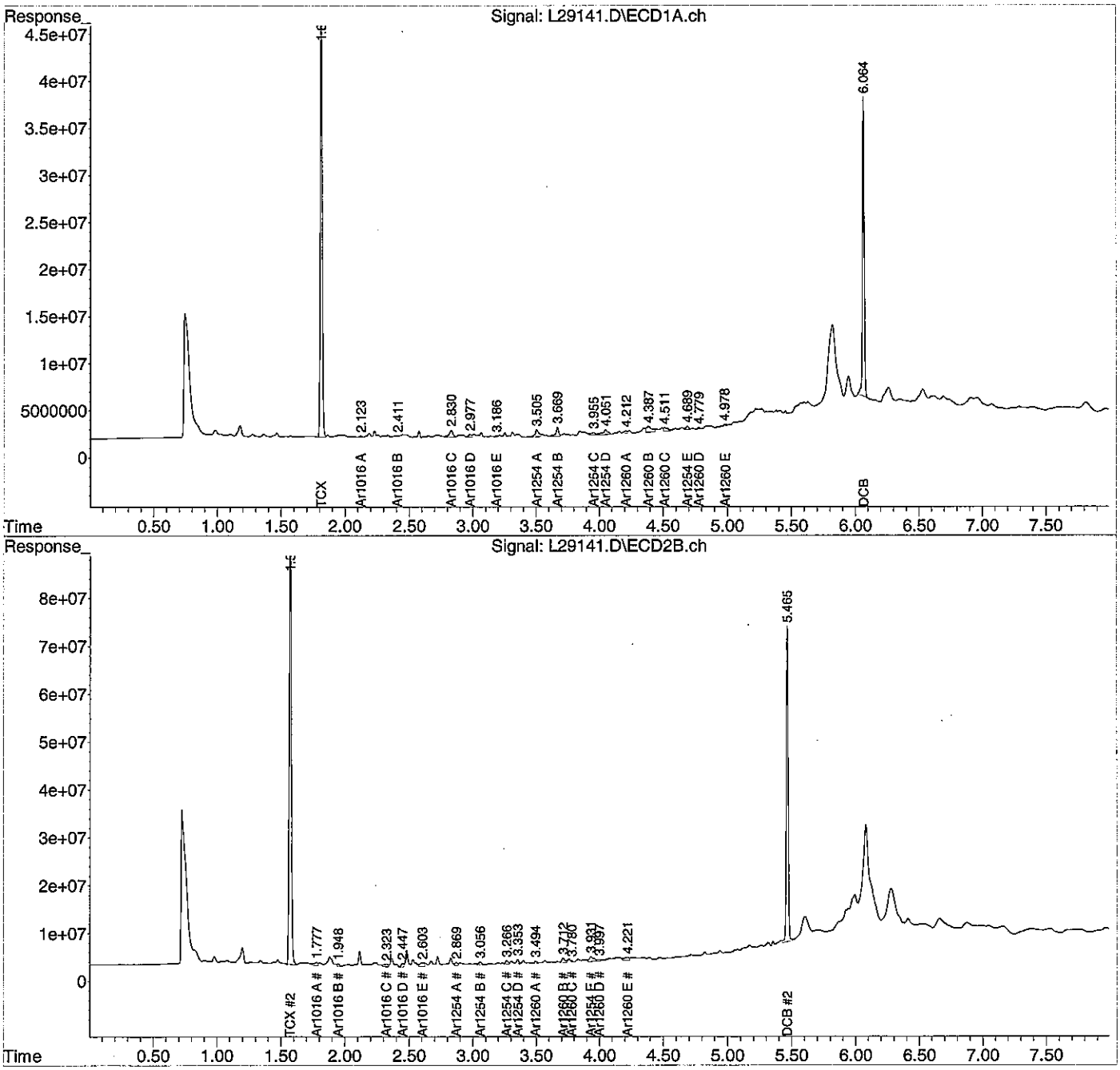
Authorized signature

Quantitation Report (QT Reviewed)

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29141.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 6:34 pm
Operator : JK
Sample : 72374-1,,A/C
Misc : SOIL
ALS Vial : 13 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Mar 27 11:43:55 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: NW3-2

SAMPLE DATA

Lab Sample ID: 72374-2
Matrix: Solid
Percent Solid: 98
Dilution Factor: 7
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	231	U
PCB-1221	231	U
PCB-1232	231	U
PCB-1242	231	U
PCB-1248	231	U
PCB-1254	231	U
PCB-1260	231	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	63	%
Decachlorobiphenyl	58	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

PCB Report

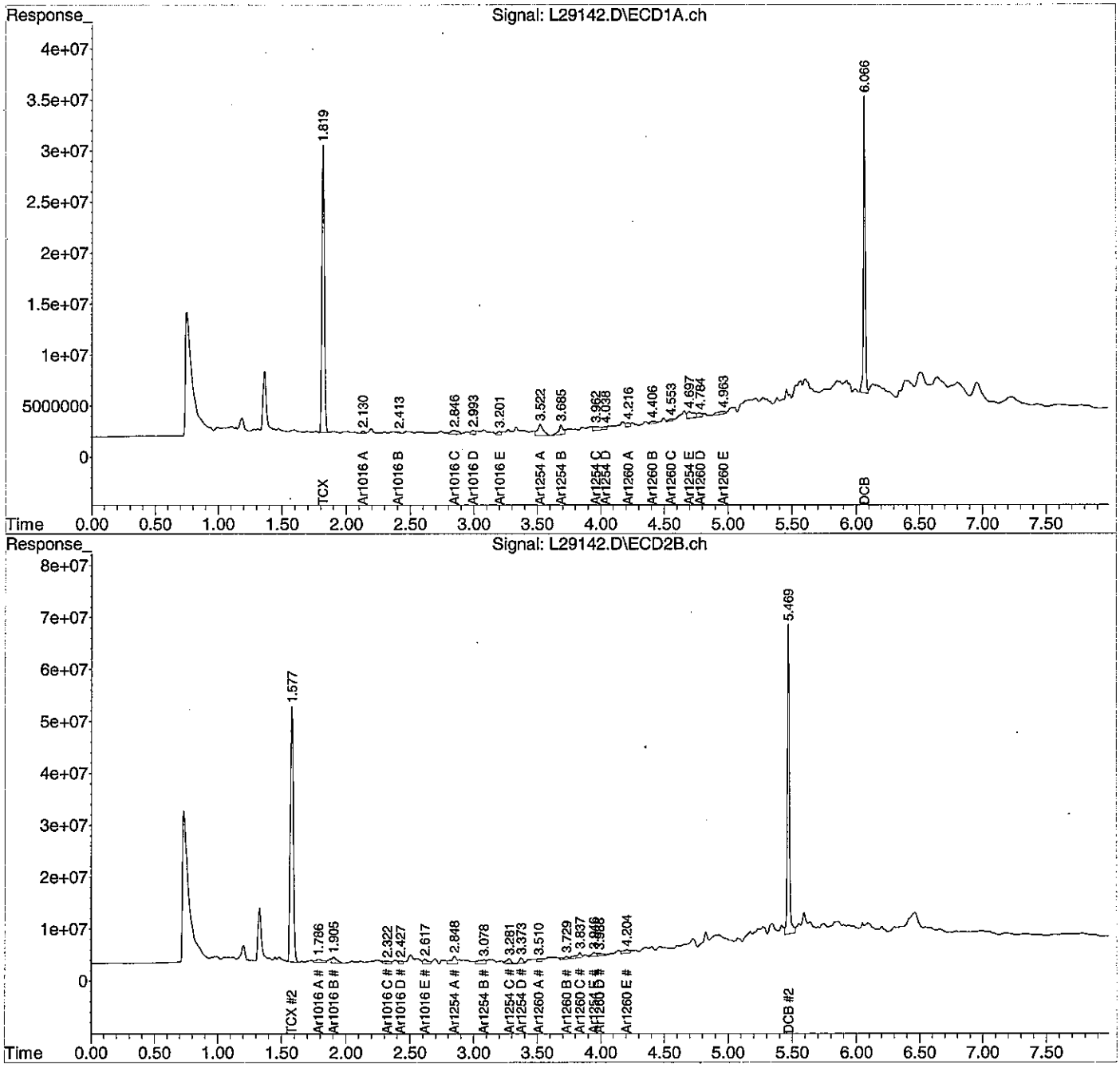
Authorized signature

Quantitation Report (QT Reviewed)

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29142.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 6:45 pm
Operator : JK
Sample : 72374-2,,A/C
Misc : SOIL
ALS Vial : 14 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Mar 27 11:43:57 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: NW3-3

SAMPLE DATA

Lab Sample ID: 72374-3
Matrix: Solid
Percent Solid: 99
Dilution Factor: 7
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	231	U
PCB-1221	231	U
PCB-1232	231	U
PCB-1242	231	U
PCB-1248	231	U
PCB-1254	231	U
PCB-1260	231	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	78	%
Decachlorobiphenyl	I	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.
I=Unable to read surrogate results due to interference.

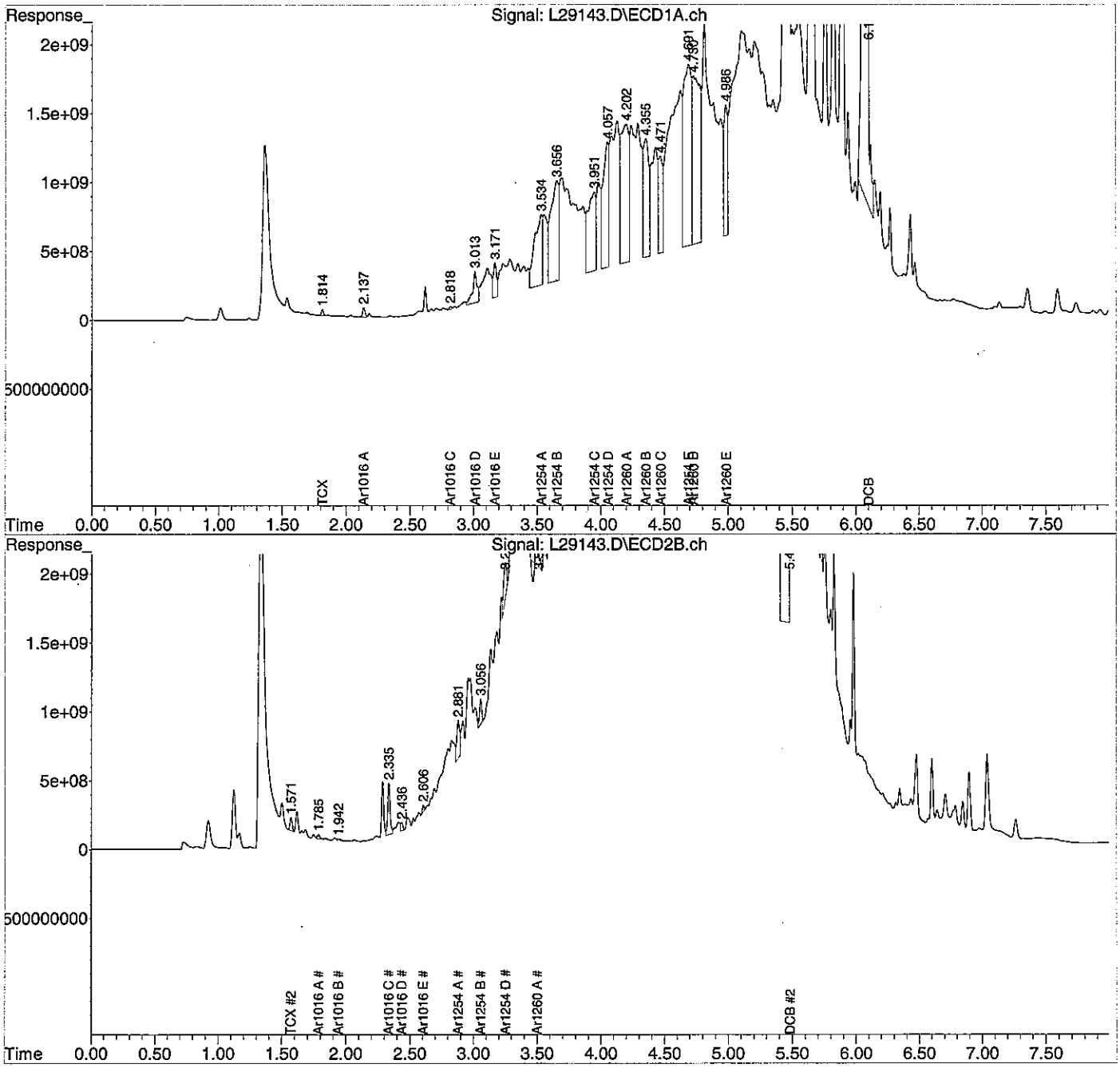
PCB Report

Authorized signature

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29143.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 6:55 pm
Operator : JK
Sample : 72374-3,,A/C
Misc : SOIL
ALS Vial : 15 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:42:55 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: SW3-4

SAMPLE DATA

Lab Sample ID: 72374-4
Matrix: Solid
Percent Solid: 97
Dilution Factor: 8
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	264	U
PCB-1221	264	U
PCB-1232	264	U
PCB-1242	264	U
PCB-1248	264	U
PCB-1254	264	U
PCB-1260	264	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	67	%
Decachlorobiphenyl	83	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

PCB Report

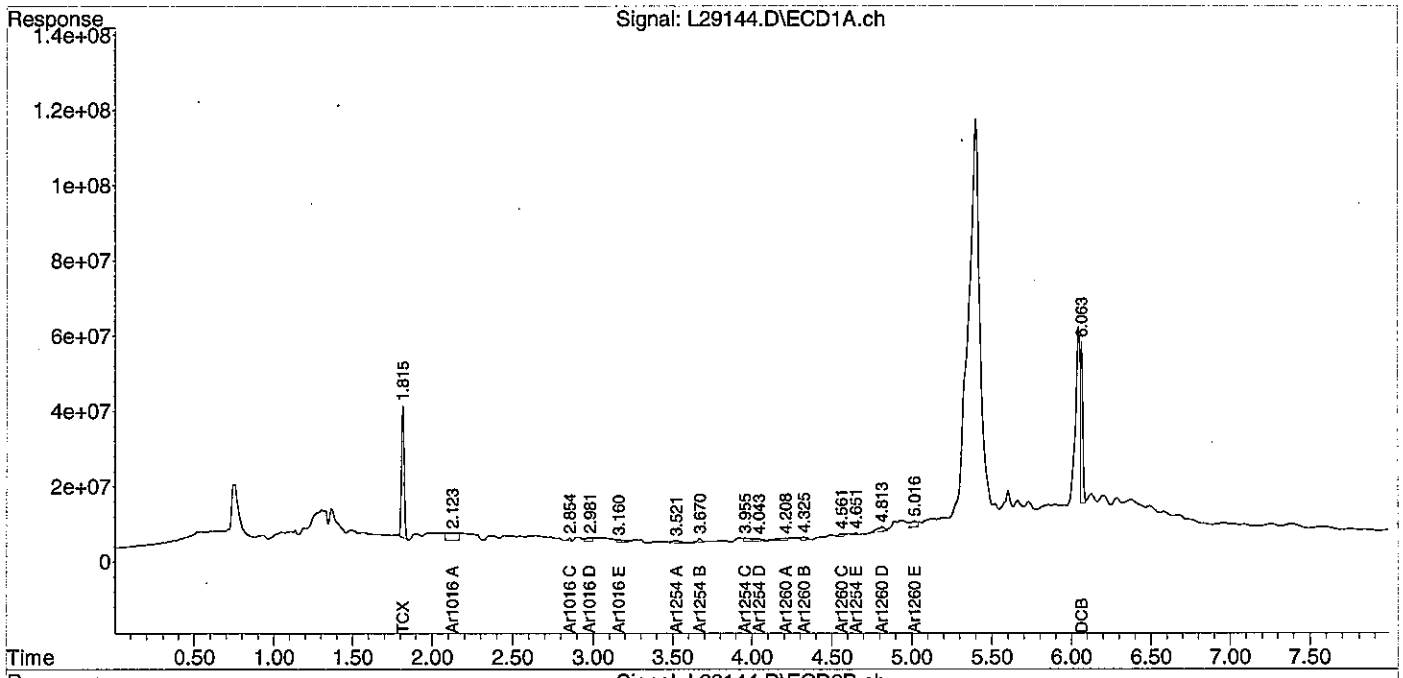
Authorized signature

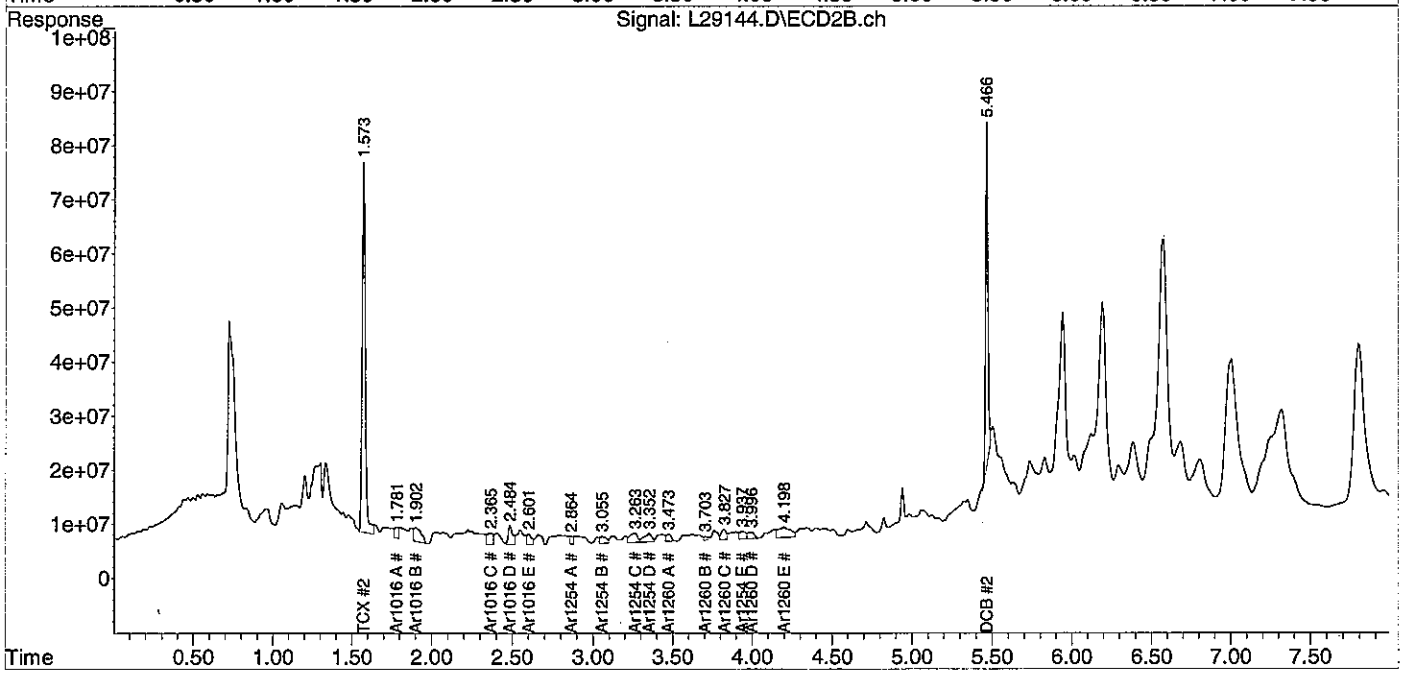
Quantitation Report (QT Reviewed)

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29144.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 7:05 pm
Operator : JK
Sample : 72374-4,,A/C
Misc : SOIL
ALS Vial : 16 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:43:26 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um





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April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: SW3-5

SAMPLE DATA

Lab Sample ID: 72374-5
Matrix: Solid
Percent Solid: 100
Dilution Factor: 6
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	198	U
PCB-1221	198	U
PCB-1232	198	U
PCB-1242	198	U
PCB-1248	198	U
PCB-1254	198	U
PCB-1260	198	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	70	%
Decachlorobiphenyl	59	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

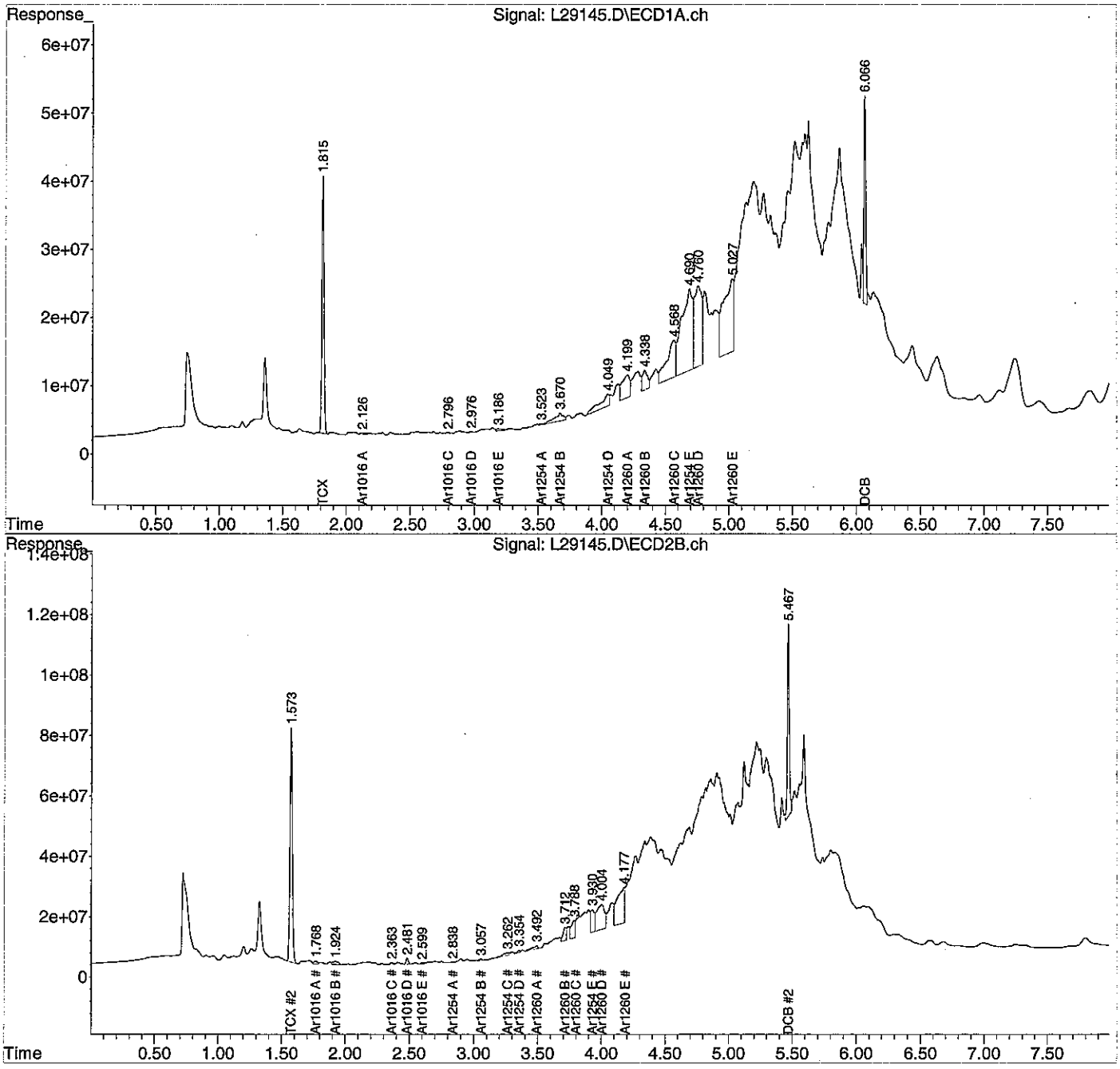
PCB Report

Authorized signature

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29145.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 7:16 pm
Operator : JK
Sample : 72374-5,,A/C
Misc : SOIL
ALS Vial : 17 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:43:53 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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Mr. Dennis Kingman
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Bangor ME 04401

April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: ND-1

SAMPLE DATA

Lab Sample ID: 72374-6
Matrix: Solid
Percent Solid: 99
Dilution Factor: 7
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	231	U
PCB-1221	231	U
PCB-1232	231	U
PCB-1242	231	U
PCB-1248	231	U
PCB-1254	231	U
PCB-1260	231	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	61	%
Decachlorobiphenyl	49	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

PCB Report

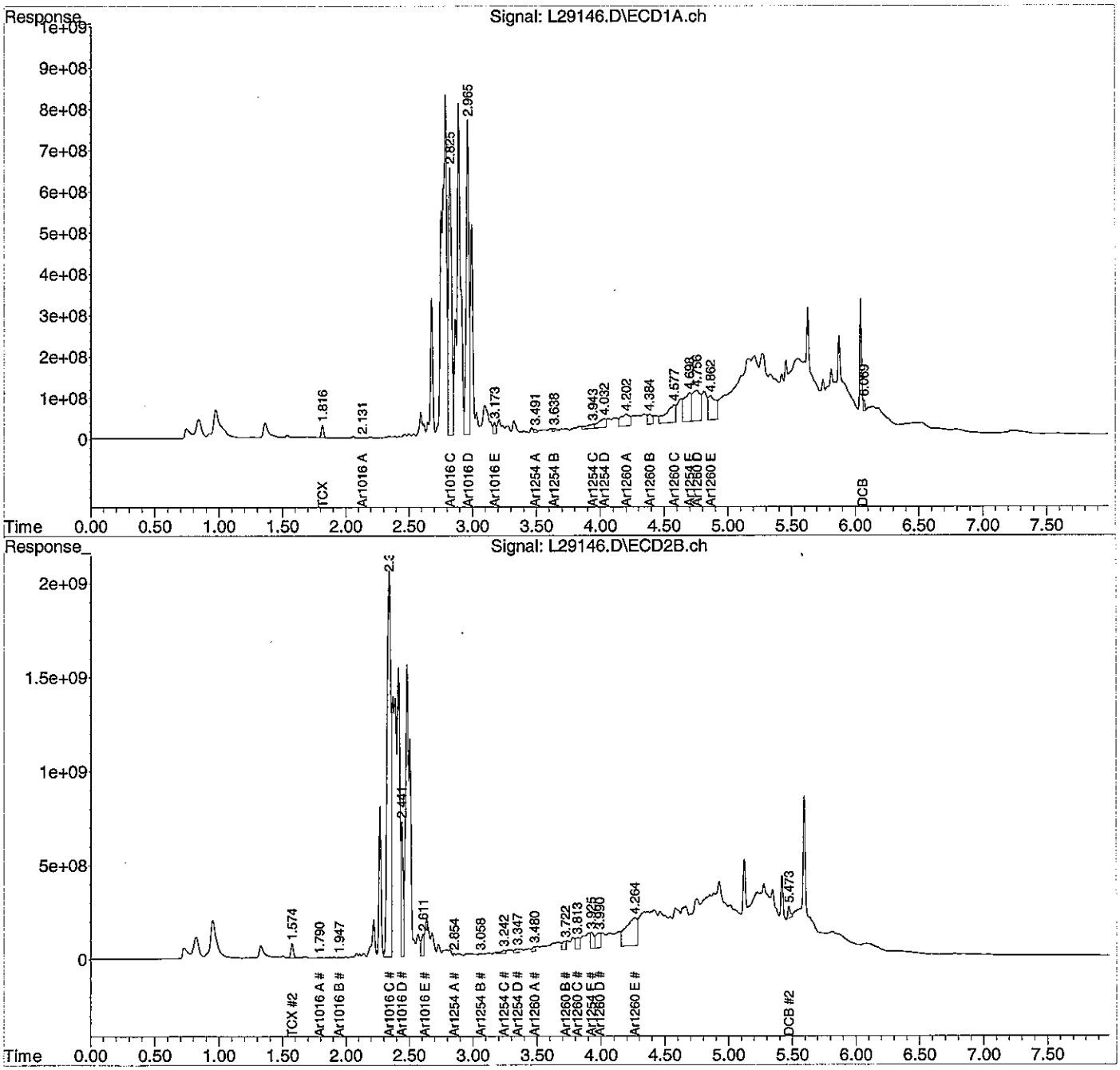
Authorized signature

Quantitation Report (QT Reviewed)

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29146.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 7:26 pm
Operator : JK
Sample : 72374-6,,A/C
Misc : SOIL
ALS Vial : 18 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:44:33 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



analytics environmental laboratory LLC

195 Commerce Way
Portsmouth, New Hampshire 03801
603-436-5111 Fax 603-430-2151
800-929-9906

Mr. Dennis Kingman
Summit Environmental
8 Harlow St. Suite 4A
Bangor ME 04401

April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: ND-2

SAMPLE DATA

Lab Sample ID: 72374-7
Matrix: Solid
Percent Solid: 99
Dilution Factor: 7
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	231	U
PCB-1221	231	U
PCB-1232	231	U
PCB-1242	231	U
PCB-1248	231	U
PCB-1254	231	U
PCB-1260	231	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	73	%
Decachlorobiphenyl	85	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

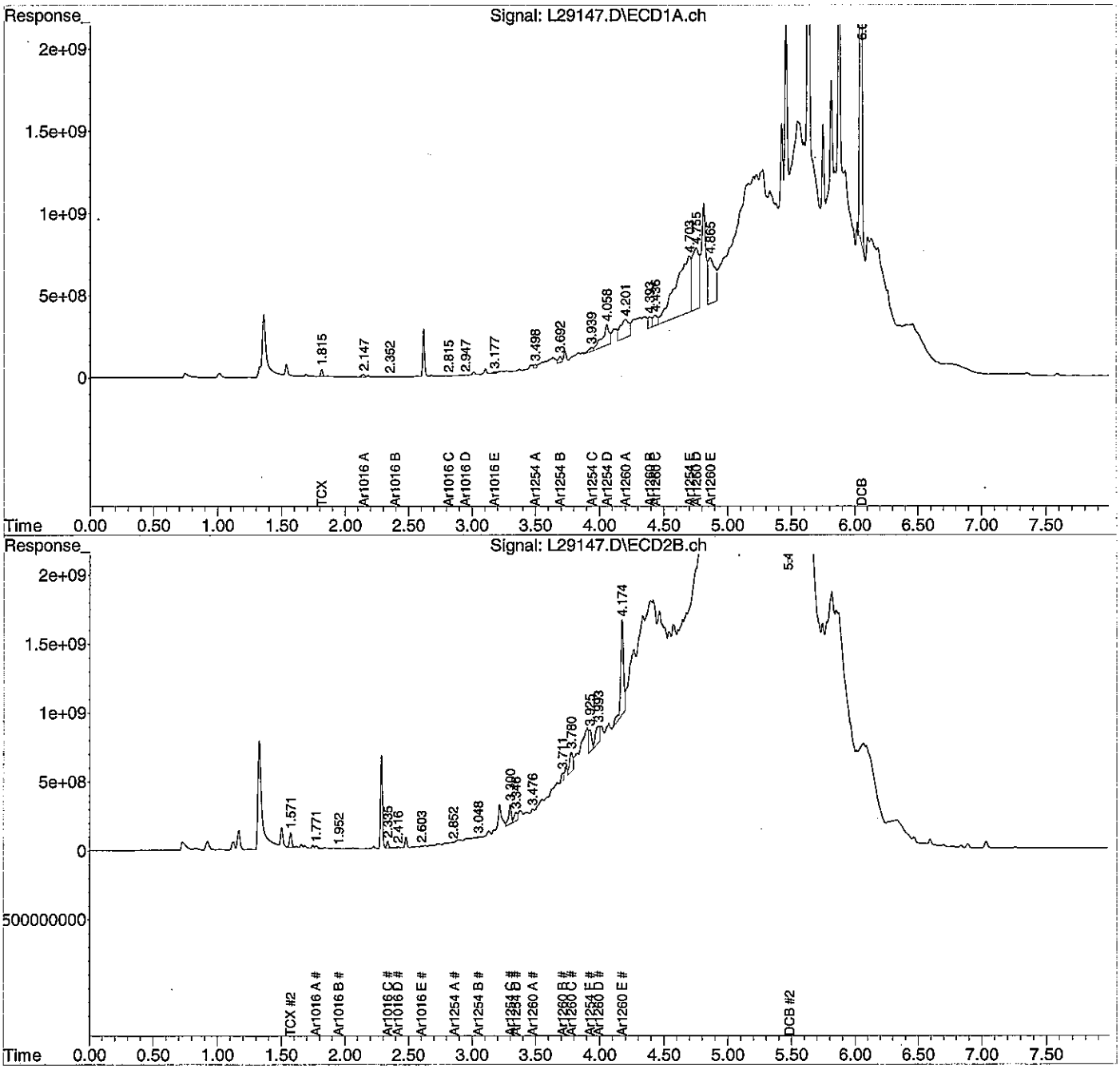
PCB Report

Authorized signature

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29147.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 7:36 pm
Operator : JK
Sample : 72374-7,,A/C
Misc : SOIL
ALS Vial : 19 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:45:18 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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Mr. Dennis Kingman
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8 Harlow St. Suite 4A
Bangor ME 04401

April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: ED-3

SAMPLE DATA

Lab Sample ID: 72374-8
Matrix: Solid
Percent Solid: 100
Dilution Factor: 6
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	198	U
PCB-1221	198	U
PCB-1232	198	U
PCB-1242	198	U
PCB-1248	198	U
PCB-1254	198	U
PCB-1260	198	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	74	%
Decachlorobiphenyl	72	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

PCB Report

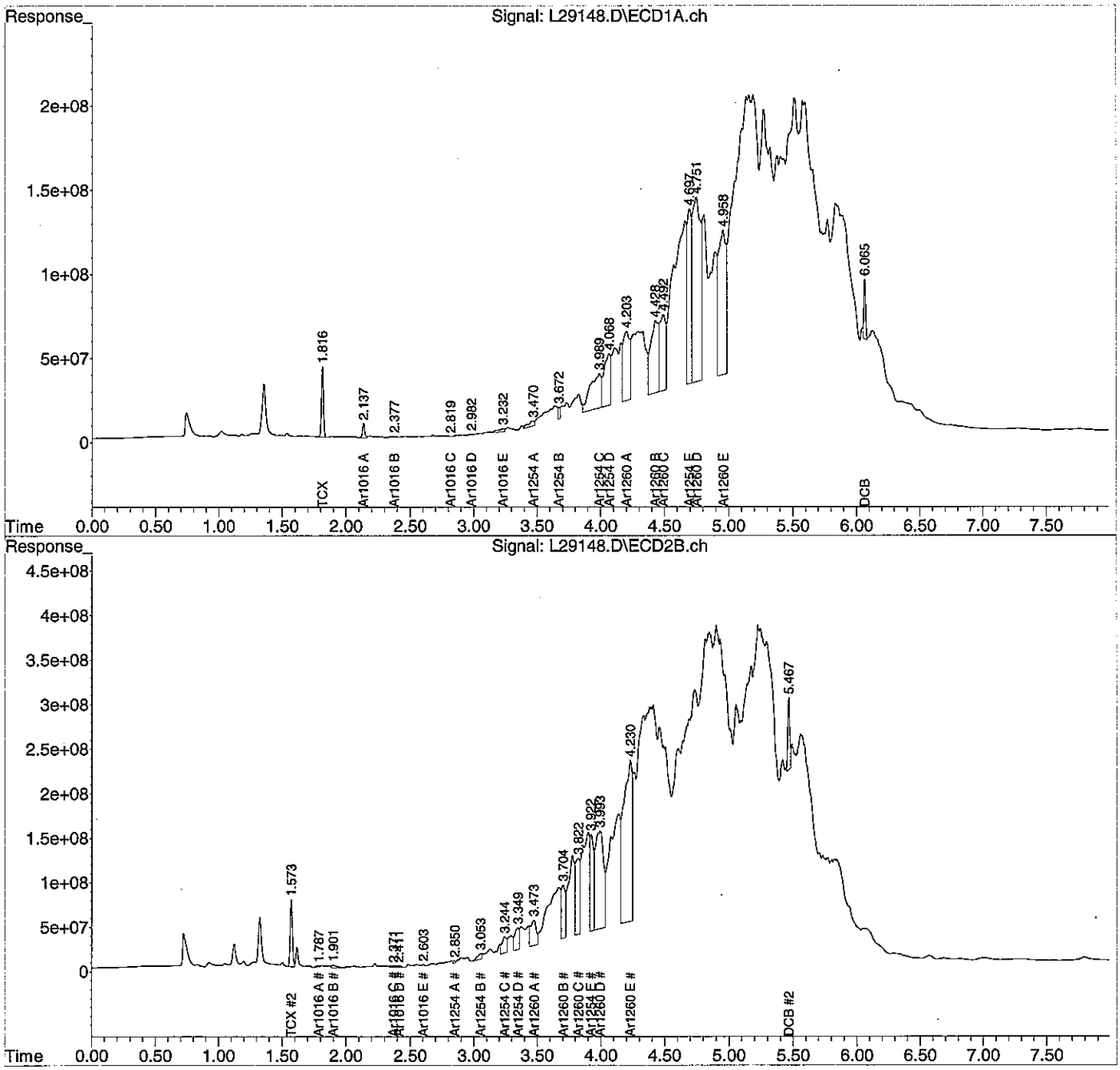
Authorized signature

Quantitation Report (QT Reviewed)

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29148.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 7:46 pm
Operator : JK
Sample : 72374-8,,A/C
Misc : SOIL
ALS Vial : 20 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:45:42 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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800-929-9906

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Bangor ME 04401

April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: SD-4

SAMPLE DATA

Lab Sample ID: 72374-9
Matrix: Solid
Percent Solid: 99
Dilution Factor: 5
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	165	U
PCB-1221	165	U
PCB-1232	165	U
PCB-1242	165	U
PCB-1248	165	U
PCB-1254	165	U
PCB-1260	165	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	84	%
Decachlorobiphenyl	I	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.
I=Unable to read surrogate results due to interference.

PCB Report

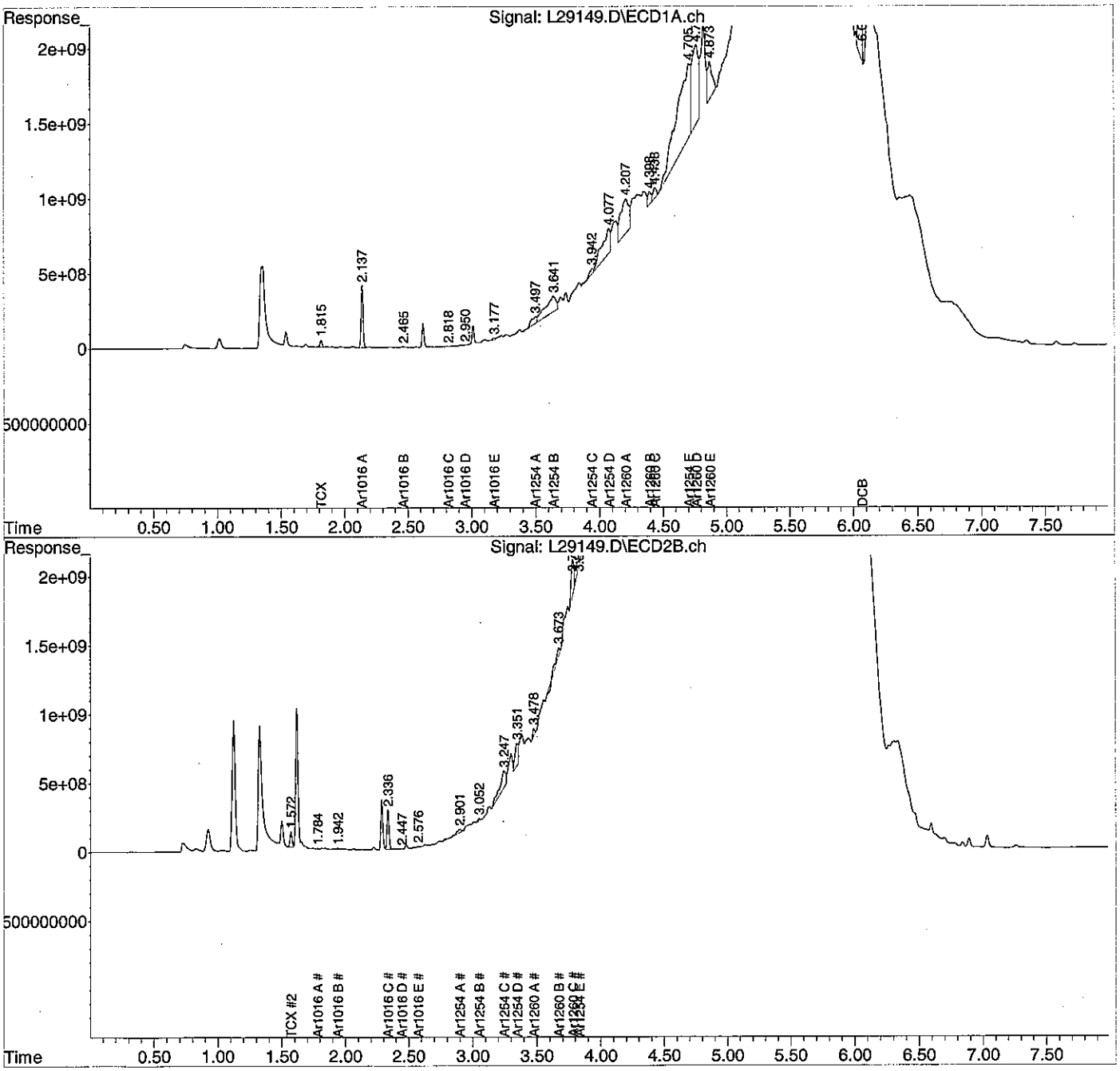
Authorized signature

Quantitation Report (QT Reviewed)

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29149.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 7:57 pm
Operator : JK
Sample : 72374-9,,A/C
Misc : SOIL
ALS Vial : 21 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:46:30 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um



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8 Harlow St. Suite 4A
Bangor ME 04401

April 2, 2012

CLIENT SAMPLE ID

Project Name: Cumberland County Civic Center

Project Number: 12-3051

Field Sample ID: SD-5

SAMPLE DATA

Lab Sample ID: 72374-10
Matrix: Solid
Percent Solid: 98
Dilution Factor: 10
Collection Date: 03/15/12
Lab Receipt Date: 03/20/12
Extraction Date: 03/20/12
Analysis Date: 03/22/12

PCB ANALYTICAL RESULTS

COMPOUND	Quantitation Limit µg/kg	Results µg/kg
PCB-1016	330	U
PCB-1221	330	U
PCB-1232	330	U
PCB-1242	330	U
PCB-1248	330	U
PCB-1254	330	U
PCB-1260	330	U

Surrogate Standard Recovery

2,4,5,6-Tetrachloro-m-xylene	86	%
Decachlorobiphenyl	60	%

U=Undetected J=Estimated E=Exceeds Calibration Range B=Detected in Blank

METHODOLOGY: Sample analysis conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 8082. Sample preparation conducted according to Test Methods for Evaluating Solid Waste, SW-846 Method 3540C. Sample cleanup was conducted according to SW-846 Method 3665A.

COMMENTS: Results are expressed on a dry weight basis.

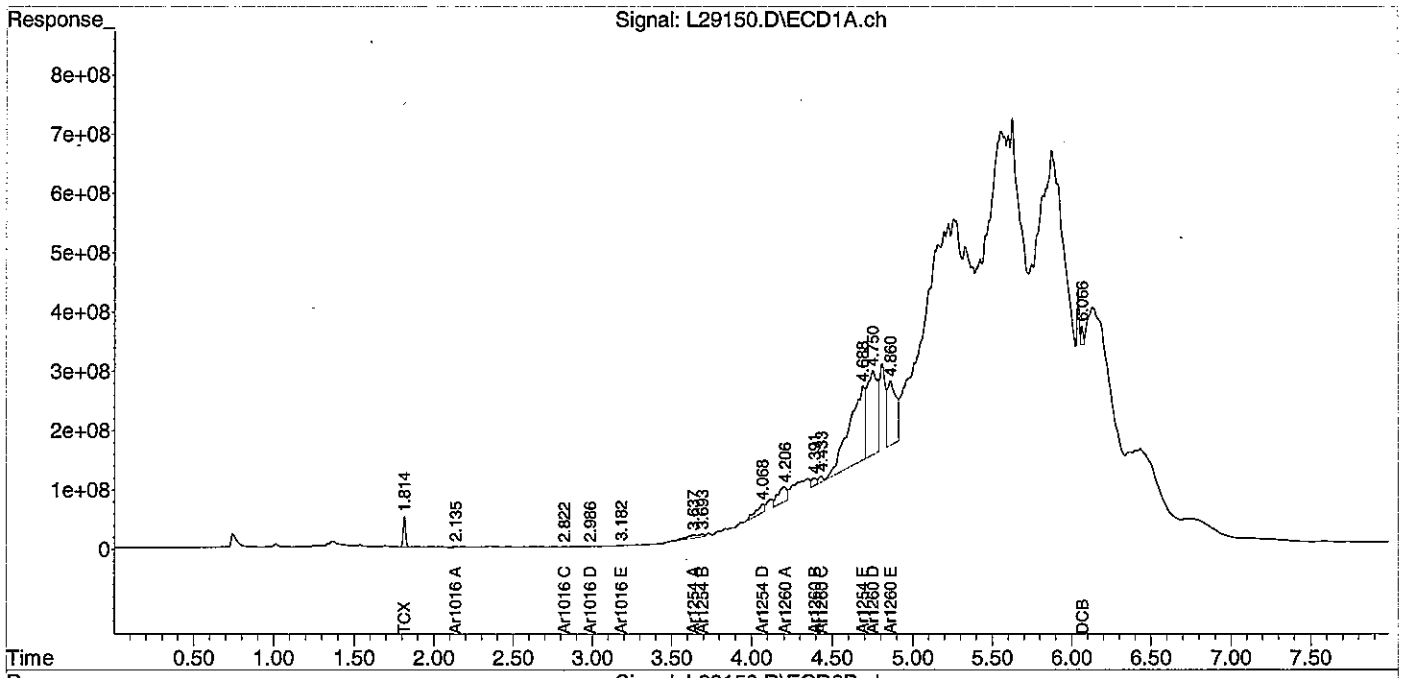
PCB Report

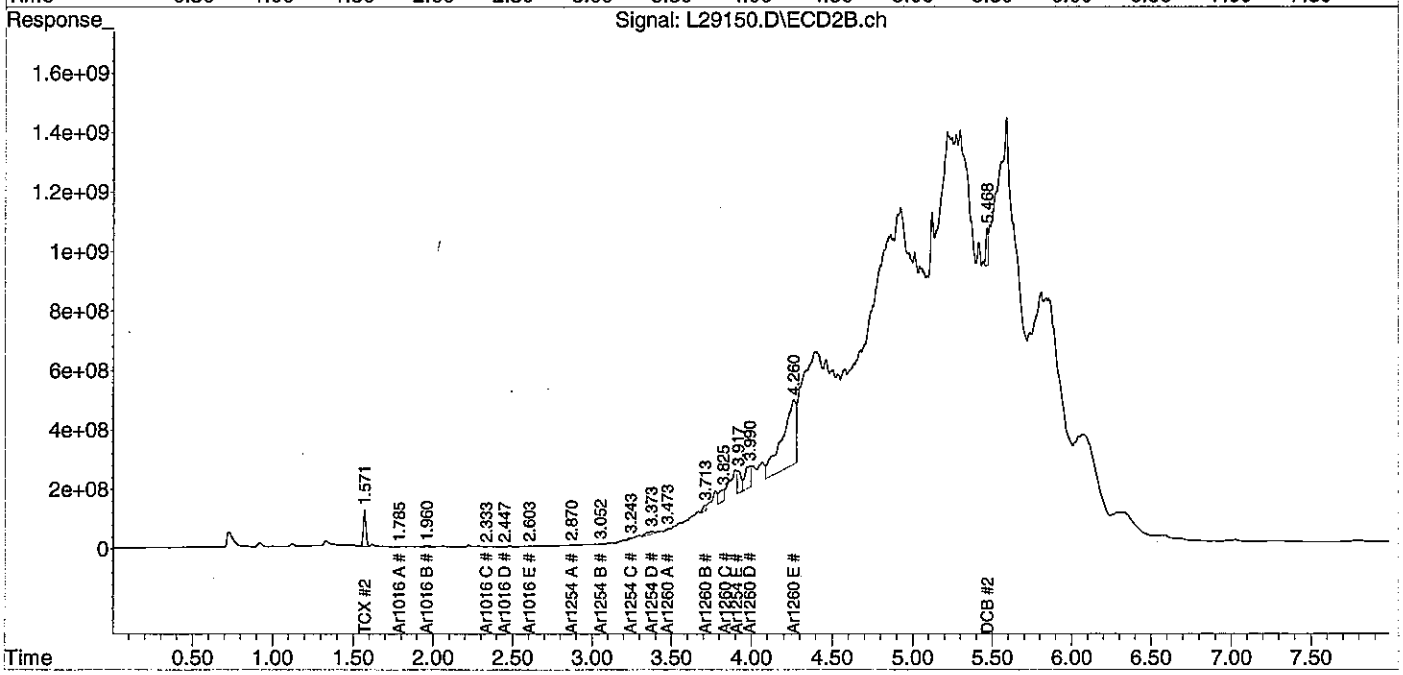
Authorized signature

Data Path : C:\msdchem\1\DATA\032112-L\
Data File : L29150.D
Signal(s) : Signal #1: ECD1A.ch Signal #2: ECD2B.ch
Acq On : 22 Mar 2012 8:07 pm
Operator : JK
Sample : 72374-10,,A/C
Misc : SOIL
ALS Vial : 22 Sample Multiplier: 1

Integration File signal 1: autoint1.e
Integration File signal 2: autoint2.e
Quant Time: Apr 02 15:47:07 2012
Quant Method : C:\msdchem\1\METHODS\PCB032112.M
Quant Title : SW-846 METHOD 8082 Aroclor 1016/1260/1254
QLast Update : Thu Mar 22 10:38:07 2012
Response via : Initial Calibration
Integrator: ChemStation

Volume Inj. : 2 uL
Signal #1 Phase : STX-CLPPesticides Signal #2 Phase: STX-CLPPesticides
Signal #1 Info : 30 m x 0.25mm x 0 Signal #2 Info : 30 m x 0.25mm x 0.25 um





PCB
QC FORMS

AnalyticsLLC:AEL Documents LLC:Pkg Dividers:PCBQC.doc

PCB SOIL
SYSTEM MONITORING COMPOUNDS
SUMMARY

Instrument ID: L
GC Column #1: STX-CLPesticides I
Column ID: 0.25 mm
GC Column #2: STX-CLPesticides II
Column ID: 0.25 mm

SDG: 72374

	Column #1				Column #2			
SAMPLE ID	SMC 1 (%)	#	SMC 2 (%)	#	SMC 1 (%)	#	SMC 2 (%)	#
B032012PSOX,RR,,A/C	75		100		62		100	
L032012PSOX,RR,,A/C	91		88		77		90	
LD032012PSOX,RR,,A/C	93		89		78		92	
72374-1,,A/C	79		60		62		53	
72374-2,,A/C	63		58		47		53	
72374-3,,A/C	78		I		68		I	
72374-4,,A/C	67		83		56		53	
72374-5,,A/C	70		59		60		55	
72374-6,,A/C	61		49		64		74	
72374-7,,A/C	77		I		73		85	
72374-8,,A/C	74		72		54		72	
72374-9,,A/C	84		I		76		I	
72374-10,,A/C	86		60		81		90	
72374-10,MS,,A/C	87		I		80		65	
72374-10,MSD,,A/C	87		I		81		I	

	Lower Limit	Upper Limit
SMC #1 = TCX	40	130
SMC #2 = DCB	40	130

\# Column to be used to flag recovery values outside of QC limits
* Values outside QC limits
D System Monitoring Compound diluted out

PCB SOIL
LABORATORY CONTROL SAMPLE/DUPLICATE
PERCENT RECOVERY

Instrument ID: L

GC Column #1: STX-CLPesticides I

Column ID: 0.25 mm

GC Column #2: STX-CLPesticides II

Column ID: 0.25 mm

SDG: 72374

Non-spiked sample: B032012PSOX,RR,,A/C

Spike: L032012PSOX,RR,,A/C

Spike duplicate: LD032012PSOX,RR,,A/C

COMPOUND	LCS SPIKE ADDED (ug/kg)	LCSD SPIKE ADDED (ug/kg)	LOWER LIMIT	UPPER LIMIT	RPD LIMIT	NON-SPIKE RESULT (ug/kg)	SPIKE RESULT (ug/kg)	SPIKE % REC	#	SPIKE DUP RESULT (ug/kg)	SPIKE DUP % REC	#	RPD	#
PCB 1016	200	200	65	140	30	0	170	85		170	85		0.0	
PCB 1260	200	200	60	130	30	0	173	86		181	91		4.6	
PCB 1016 #2	200	200	65	140	30	0	163	82		184	92		11.9	
PCB 1260 #2	200	200	60	130	30	0	183	91		192	96		5.1	

Column to be used to flag recovery and RPD values outside of QC limits

* Values outside QC limits

LCS/LCSD spike added values have been weight adjusted.

Non-spike result of "0" used in place of "U" to allow calculation of spike recovery.

Comments: _____

_____

PCB SOIL
MATRIX SPIKE/DUPLICATE
PERCENT RECOVERY

Instrument ID: L

GC Column #1: STX-CLPesticides I

Column ID: 0.25 mm

GC Column #2: STX-CLPesticides II

Column ID: 0.25 mm

SDG: 72374

Non-spiked sample: 72374-10,,A/C

Spike: 72374-10,MS,,A/C

Spike duplicate: 72374-10,MSD,,A/C

COMPOUND	MS SPIKE ADDED (ug/kg)	MSD SPIKE ADDED (ug/kg)	LOWER LIMIT	UPPER LIMIT	RPD LIMIT	NON-SPIKE RESULT (ug/kg)	SPIKE RESULT (ug/kg)	SPIKE % REC	#	SPIKE DUP RESULT (ug/kg)	SPIKE DUP % REC	#	RPD	#
PCB 1016	1725	1100	65	145	30	0	1437	83		936	85		42.2	*
PCB 1260	1725	1100	65	145	30	0	2420	140		1367	124		55.6	*
PCB 1016 #2	1725	1100	65	145	30	0	2431	141		1002	91		83.3	*
PCB 1260 #2	1725	1100	65	145	30	0	1756	102		1364	124		25.1	

Column to be used to flag recovery and RPD values outside of QC limits

* Values outside QC limits

MS/MSD spike added values have been weight adjusted.

Non-spike result of "0" used in place of "U" to allow calculation of spike recovery.

Comments: _____

_____

analytics environmental laboratory LLC

CHAIN OF CUSTODIES

AnalyticsLLC:AEL Documents LLC:Pkg Dividers:COC.doc

Chain Of Custody Form

analytics environmental laboratory LLC
195 Commerce Way, Suite E
Portsmouth, NH 03801
(800) 929-9906
(603) 436-5111
(603) 430-2151 Fax

For Analytics Use Only
Samples were:
1) Shipped or hand-delivered
2) Temperature (°C): 5.5
3) Received in good condition: Y or N
4) pH checked by: N/A
5) Labels checked by: DW 3/20/12

Project Name: Cumberland County Civic Center
Project#: 12-3051
Company: Summit Environmental
Report to: Dennis Kingman
Address: 8 Harlow St Suite 4A
Bangor, ME 04401
Phone: 207-262-9040
Quote #:
PO# (if required):

Preservation Code: Please fill in preservation code here
Preseravtion Key: A= HCL; B= 4°C; C= Unpres; D = MeOH; E = HNO3; F = H2SO4; G = Hexane; H = Other

Circle and/or Write Required Analysis Followed by Preservation Code

Sample Identification	Sample Date	Sample Time	Field Filtered? Y or N	VOC: 8260 524.2 624	SVOC: 8270 625 PAH only SIM	Pesticides: 8081 608	PCB: 8082 608 Soxhlet? Y or N	TPH: 8015 (Gas Range) ME4217	TPH: 8015 (Diesel Range) 8100M ME4125	EPH: Full or Ranges only TETPH	VPH: Full or Ranges only	Metals: RCRA8 PP13 TAL23 Other**	Matrix	No. of Containers	pH checked	Analytics Sample #
NW3-1	3/15/12	1415	N				✓						X	1	←	72374-1
NW3-2		1420														2
NW3-3		1440														3
SW3-4		1510														4
SW3-5		1535														5
ND-1		1445														6
ND-2		1445														7
ED-3		1510														8
SD-4		1525														9
SD-5		1540								✓						10

Matrix Key: C = Concrete; WP = Wipe; WW = Wastewater; SW = Surface Water; E = Extract; GW = Groundwater; DW = Drinking Water; S = Soil / Sludge; O = Oil; X = Other

Email Results to: DKingman@summitenv.com

Comments, Additional Analyses, or Special Instructions: ** List requested metals here
PCB Bulk Caulk
Soxhlet extraction

Turnaround Time (TAT)
☐ 24 Hours* ☐ 48 Hours*
☐ 72 Hours* ☐ 5 Days*
☒ ~~10~~ Days
*Fee may apply; lab approval required

Please note: For volatile analyses, a trip blank has been provided in the cooler. If you want the trip blank run and reported please write the trip blank on the COC. Trip Blank analyses will be charged unless other arrangements have been made.

Project Requirements: *Fee may apply
Report Type: ☐ MCP* ☒ Level II* ☐ CTRCP* ☐ Level III* ☐ DOD* ☐ Level IV* ☐ Standard
State: ☐ NH ☐ MA ☒ ME ☐ CT ☐ RI Other:
State Standard: _____ (eg. S-1 or GW-1)
EDD Required: Y* N Type:

Sampler Name (Print): Dennis Kingman

	Date	Time	
Relinquished By Sampler: Dennis Kingman	3-19-12	1800	Received By: Fed Ex
Relinquished By: Fed Ex	3/20/12	930	Received By: Cary
Relinquished By:	Date:	Time:	Received By:

Page ___ of ___

ANALYTICS SAMPLE RECEIPT CHECKLIST

analytics environmental laboratory LLC

AEL LAB#: 72374 COOLER NUMBER: 264

CLIENT: Summit NUMBER OF COOLERS: 1

PROJECT: Cumberland County Civic Center

A: PRELIMINARY EXAMINATION:

1. Cooler received by(initials): CP DATE COOLER RECEIVED/OPENED: 3/20/12

2. Circle one: Hand delivered (If so, skip 3) (Shipped)

3. Did cooler come with a shipping slip? (Y) N

3a. Enter carrier name and airbill number here: FedEx 7981 8392 9722

4. Were custody seals on the outside of cooler? Y (N)
How many & where: _____ Seal Date: _____ Seal Name: _____

5. Did the custody seals arrive unbroken and intact upon arrival? (Y) N

6. COC#: ✓

7. Were Custody papers filled out properly (ink,signed, legible, project information etc)? (Y) N

8. Were custody papers sealed in a plastic bag? (Y) N

9. Did you sign the COC in the appropriate place? (Y) N

10. Was enough ice used to chill the cooler? (Y) N Temp. of cooler: 5.5 on ice

B. Log-In: Date samples were logged in: 3/20/12 By: CP

11. Were all bottles sealed in separate plastic bags? (Y) N

12. Did all bottles arrive unbroken and were labels in good condition? (Y) N

13. Were all bottle labels complete(ID,Date,time,etc.) (Y) N

14. Did all bottle labels agree with custody papers? (Y) N

15. Were the correct containers used for the tests indicated: (Y) N

16. Were samples received at the correct pH? Y (N/A)

17. Was sufficient amount of sample sent for the tests indicated? (Y) N

18. Were all samples submitted within holding time? (Y) N

19. Were VOA samples absent of greater than pea-sized bubbles? Y (N*/A)
(Note:Pea-sized bubbles or smaller are acceptable and are not considered to adversely affect volatiles data.)

If NO, List Sample ID's, Lab #s: _____

*When bubbles are present in VOA samples they are labelled from smallest (or no bubbles) to largest. Lab to analyze VOA samples with no bubbles or smallest bubbles first

20. Laboratory labeling verified by (initials): DW Date: 3/20/12

From: (207) 262-9040 Origin ID: BGRA
Dennis Kingman
SUMMIT ENVIRONMENTAL CONSULT
8 HARLOW STREET
SUITE 4A
BANGOR, ME 04401

FedEx Express

J12101112190225

Ship Date: 19MAR12
ActWgt: 20.0 LB
CAD: 1957951/INET3250

Delivery Address Bar Code

SHIP TO: (603) 436-5111 BILL SENDER
Steve Knollmeyer
Analytics Environmental Laboratory
195 COMMERCE WAY UNIT E

PORTSMOUTH, NH 03801

Ref # 12-3051
Invoice #
PO #
Dept #

TUE - 20 MAR A2
STANDARD OVERNIGHT

TRK# 7981 8392 9722
0201

03 IGGA

03801
NH-US
MHT

512G1/81D5/A278

After printing this label:
1. Use the 'Print' button on this page to print your label to your laser or inkjet printer.
2. Fold the printed page along the horizontal line.
3. Place label in shipping pouch and affix it to your shipment so that the barcode portion of the label can be read and scanned.

Warning: Use only the printed original label for shipping. Using a photocopy of this label for shipping purposes is fraudulent and could result in additional billing charges, along with the cancellation of your FedEx account number.

Use of this system constitutes your agreement to the service conditions in the current FedEx Service Guide, available on fedex.com.FedEx will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay, non-delivery,misdelivery,or misinformation, unless you declare a higher value, pay an additional charge, document your actual loss and file a timely claim.Limitations found in the current FedEx Service Guide apply. Your right to recover from FedEx for any loss, including intrinsic value of the package, loss of sales, income interest, profit, attorney's fees, costs, and other forms of damage whether direct, incidental,consequential, or special is limited to the greater of $100 or the authorized declared value. Recovery cannot exceed actual documented loss.Maximum for items of extraordinary value is $500, e.g. jewelry, precious metals, negotiable instruments and other items listed in our ServiceGuide. Written claims must be filed within strict time limits, see current FedEx Service Guide.

Appendix F

MEDEP Forms X and Y

Asbestos Bulk Sampling Protocols and Disclosure	State of Maine Department of Environmental Protection Lead & Asbestos Hazard Prevention Program 17 State House Station, Augusta, ME 04333 TEL (207) 287-2651 FAX (207) 287-6220	**FORM X** Page 1 of 1 2011

Asbestos Bulk Sampling

Bulk samples must be collected by a Department-certified Inspector in a random manner such that they are representative of each homogenous area. Bulk samples shall be collected and analyzed for all asbestos abatement activities unless an approved disclosure is received by the owner or owner's agent from the operator prior to the start of the project.

An asbestos consultant may implement an alternative sampling protocol that collects more but not less than the number of samples per homogeneous area, provided the asbestos consultant has informed the building owner or owner's agent of the standard sampling protocol set forth below prior to the sampling event. The asbestos consultant must document that the building owner or owner's agent received information regarding the standard sampling protocol set forth in this section by obtaining the building owner's or owner's agent's signature on a statement acknowledging receipt of the information before the sampling event begins.

Standard Sampling Protocol

- Surfacing Material: 3 bulk samples from each homogenous area and/or material that is 1,000 square feet or less. 5 bulk samples from each homogenous area that is greater than 1,000 square feet but less than or equal to 5000 square feet. 7 bulk samples from each homogenous area that is greater than 5,000 square feet.
- Thermal System Insulation: 3 bulk samples from each homogenous area. 1 bulk sample from each homogenous area of patched thermal system insulation if the patched section is less than 6 linear or square feet. Samples sufficient to determine whether the material is ACM from each insulated mechanical system where cement is utilized on tees, elbows, or valves.
- Miscellaneous ACM: 3 samples from each miscellaneous material. 1 sample if the amount of miscellaneous material is less than 6 square or linear feet.

Asbestos Bulk Sampling Disclosure

I have reviewed and understand the Standard Sampling Protocol and any benefits and associated costs of an Alternative Sampling Protocol with Summit Environmental Consultants, Inc., a Maine licensed Asbestos Consultant. I also understand that a copy of this completed form must be available upon request by the MDEP.

Neal Pratt - CC Board Chair
Signature (Building Owner/Agent)

Neal Pratt
Print Name

Date 3/7/12

Facility Location(where bulk sampling is to take place)

BLDG Name Cumberland County Civic Center

Physical Address One Civic Center Square City Portland

Floor and/or Rm.# Entire Building

Asbestos Bulk Sample Analysis Protocols and Disclosure	State of Maine Department of Environmental Protection Lead & Asbestos Hazard Prevention Program 17 State House Station, Augusta, ME 04333 TEL (207) 287-2651 FAX (207) 287-6220	FORM Y Page 1 of 2 2011

Bulk Sample Analysis

Bulk samples collected must be analyzed by a Department-licensed Asbestos Analytical Laboratory. Bulk samples shall be analyzed until a positive result is obtained or all samples have been analyzed. Reanalysis is not required if the sample result is less than 1%. Wherever there is a suspect asbestos-containing material and a mastic/adhesive affixed to that material, the mastic/adhesive shall be analyzed and reported separately from the suspect asbestos-containing material.

Standard Analytical Methods

- Surfacing Materials, Thermal System Insulation and Cementitious Materials: PLM–EPA 600/R-93/116 visual estimation method (1993).
- Non-friable Organically Bound Materials (NOB): PLM NOB–EPA 600/R-93/116 with gravimetric preparation method. (including but not limited to floor tiles, asphalt shingles, caulking, glazing, mastics, coatings, sealants, adhesives and glues)

Alternative Analytical Methods

- Surfacing Materials and Thermal System Insulation: PLM EPA/600/R-93/116 (200 Point Count); PLM EPA/600/R-93/116 (400 Point Count); or PLM EPA/600/R-93/116 (1000 Point Count). May be used whenever the asbestos analytical laboratory has reported friable bulk samples with an asbestos content of less than 10% using the standard visual estimation.
- Surfacing Materials, Thermal System Insulation and Cementitious Materials: EPA 600/R-93/116 section 2.5.5.2 (TEM % by Mass). May be used whenever the asbestos analytical laboratory has determined is it not feasible or appropriate to have bulk sample(s) analyzed using the standard visual estimation.
- Non-friable Organically Bound Materials (NOB): PLM EPA/600/R-93/116 (200 Point Count); PLM EPA/600/R-93/116 (400 Point Count); or PLM EPA/600/R-93/116 (1000 Point Count). May be used whenever the asbestos analytical laboratory has reported an NOB sample with an asbestos content of less than 10% using the standard visual estimation.
- Non-friable Organically Bound Materials (NOB): TEM EPA NOB EPA/600/R-93/116b section 2.5, and TEM Chatfield method. May be used whenever the asbestos analytical laboratory has determined is it not feasible or appropriate to have bulk sample(s) analyzed using the standard visual estimation.

Important Notice

An analytical laboratory may use TEM, or other Department-approved analytical method, for bulk sample rather than the standard PLM analytical method. The Asbestos Consultant that collected the bulk samples for the building owner must document that the building owner or owner's agent received information regarding the standard analytical protocol set forth in the rule by obtaining the building owner's or owner's agent's signature on a statement acknowledging receipt of the information before the alternative analytical methods are employed.

Asbestos Bulk Sample Analysis Protocols and Disclosure	State of Maine Department of Environmental Protection Lead & Asbestos Hazard Prevention Program 17 State House Station, Augusta, ME 04333 TEL (207) 287-2651 FAX (207) 287-6220	FORM Y Page 2 of 2 2011

Asbestos Bulk Sample Analysis Disclosure

Asbestos Design Consultant

I have reviewed the Standard Analytical Protocols with the building owner/agent. I have also advised the building owner or the building owner's agent that whenever the asbestos analytical laboratory has determined it is not feasible or appropriate to have bulk sample(s) of suspect asbestos-containing surfacing materials analyzed using the standard method, the building owner or the building owner's agent may then either elect to treat the suspect bulk material(s) as asbestos-containing with no further analysis required, or may consent to the use of an alternative analytical method to determine whether the suspect bulk sample(s) is asbestos-containing. I also understand that a copy of this completed form must be available upon request at the asbestos project site.

Signature (Asbestos Design Consultant)

Dennis B. Kingman, Jr. CHMM
Print Name

Date March 1, 2012

Building Owner/Agent

I have reviewed the Asbestos Bulk Sample Analysis Protocols with the above Asbestos Design Consultant. I further understand that whenever the asbestos analytical laboratory has determined it is not feasible or appropriate to have bulk sample(s) of suspect asbestos-containing surfacing materials analyzed using the standard method, I may then either elect to treat the suspect bulk material(s) as asbestos-containing with no further analysis required, or may consent to the use of an alternative analytical method to determine whether the suspect bulk sample(s) is asbestos-containing.

RA - CC Board Chair
Signature (Building Owner/Agent

Neal Pratt
Print Name

Date 3/7/12

Facility Location(where bulk samples were collected)

BLDG Name Cumberland County Civic Center

Physical Address One Civic Center Square City Portland

Floor and/or Rm.# Entire building

Building Code Report

Project No. 7657.00

July 24, 2012

Cumberland County Civic Center

Portland, Maine

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TABLE OF CONTENTS

Page

1.0 INTRODUCTION

This Report presents the Building Code Approach for the Cumberland County Civic Center in Portland, Maine. This Building Code Report has been developed to establish and document approaches to major fire and life safety concerns.

This Report addresses the major fire protection aspects of Cumberland County Civic Center including:

- Fire-resistive Construction
- Exiting Systems
- Smoke Control System for Atrium
- Fire Suppression Systems
- Fire Alarm System
- Emergency Alarm and Communications Systems
- Emergency and Standby Power

The approaches contained within the Building Code Approach are intended to meet the requirements of the applicable codes.

2.0 SCOPE

This Report outlines major fire and life safety code criteria affecting the design of the Cumberland County Civic Center. Criteria are summarized primarily from the Maine Uniform Building and Energy Code (an Amended 2009 International Building Code (IBC)) and the 2009 NFPA 101 *Life Safety Code* (NFPA 101), as well as the City of Portland Fire Prevention and Protection code, which incorporates amended 2009 Editions of NFPA 1 Fire Code and NFPA 101 *Life Safety Code*, the City of Portland Technical Standard, and the City of Portland Fire Department Rules and Regulations. Major life safety design approaches have been summarized in Section 5.0, *Fire Protection Approach*.

3.0 BUILDING DESCRIPTION

The Cumberland County Civic Center is an existing Arena with a maximum occupant load of 8,700 based on a concert seating arrangement. Circulation levels and amenities are as follows:

- Mechanical Level (@ 50 feet – 10 inches)
  This level includes a mechanical room, electrical switch gear room, emergency generator, fire pump, and lobby circulation space. This level and the Event Floor are considered as one story.
- Event Floor (@ 67 feet – 2 ½ inches)
  This level includes offices, ticketing, a meeting room, commissary, loading/staging area, locker rooms, a star dressing room, ice suites, toilet rooms, storage, and other back-of-house spaces.
- Concourse Level (@ 76 feet – 0 inches)
  This level includes a circulation concourse, ticketing, team store, two suites, toilets, concessions, and other back-of-house spaces.
- Northwest Entry Level (@ 89 feet – 6 ½ inches)
  This level includes a lobby, two suites, offices, toilet rooms, and other back-of-house spaces and is considered a mezzanine to the Concourse Level.
- Suite Level (@ 103 feet – 7 ½ inches)
  This level includes two suites and is considered a mezzanine to the Concourse Level.

4.0 CODES AND STANDARDS

The City of Portland, Maine is currently enforcing the Maine Uniform Building & Energy Code (an Amended 2009 International Building Code (IBC)) and the 2009 Life Safety Code (NFPA 101). The following additional codes are enforced:

- 2009 NFPA 54 National Fuel Gas Code
- 2009 NFPA 1 National Fire Code
- 2008 National Electrical Code (NFPA 70, NEC)
- 2010 Maine State Plumbing Code (2009 Uniform Plumbing Code)
- 2010 Americans with Disabilities Act (ADA)
- 2009 International Existing Building Code (IEBC)
- 2009 International Energy Conservation Code (IECC)
- ASHRAE 62.1 – 2007
- ASHRAE 62.2 – 2007
- ASHRAE 90.1 – 2007
- ASTM E1465-06
- City of Portland Technical Manual – Section 3
- 2010 NFPA 72 National Fire Alarm and Signaling Code
- City of Portland Fire Department Rules and Regulations

5.0 FIRE PROTECTION APPROACH

This Report describes the Building Code Approach for the Cumberland County Civic Center.

This Report addresses the following major issues:

- Occupancy
- Fire-resistive Construction
- Exiting Systems
- Smoke Control System for Atrium
- Fire Suppression Systems
- Fire Detection Systems
- Emergency Alarm and Communications Systems
- Standby Power
- Firefighting Access and Facilities

5.1 OCCUPANCY

The building is a three-story building with a height of approximately 77 feet (measured to the roof line), and contains use groups A-4, B, S-1, and S-2 (IBC) and Assembly >300, Business, and Storage (NFPA 101) occupancies.

The Northwest Entry Level and Suite Level are considered mezzanines to the Concourse Level. Per Section 8.6.9.2.1 of the 2009 Edition of NFPA 101, the aggregate area of mezzanines within a room is limited to 1/3 the area of the room in which the mezzanines are located. This is more restrictive than the 2009 IBC which allows up to ½ of the floor area when the building is non-combustible construction, fully sprinklered, and provided with an emergency voice/alarm communication system. The aggregate area of the mezzanines is 7,569 square feet and the area of the Seating Bowl is 62,687 square feet. This 12%, which is less than 33%. Portions of the mezzanines are enclosed. Per Section 8.6.9.3 of the 2009 Edition of NFPA 101, enclosed mezzanines are permitted if the occupancy load of the enclosed space is less than 10 or if a mezzanine has two or more means of egress and if not less than one means of egress provides direct access from the enclosed area to an exit at the mezzanine level. This is more restrictive than the 2009 IBC which provides leniency for mezzanines in buildings which are fully sprinklered.

The office area is enclosed and the Suites are open to below. Since the occupanct load of the enclosed portion of the office is 10 or less, the Northwest Entry Level and Suite Level meet the mezzanine requirements of the 2009 Edition of NFPA 101 and the 2009 IBC.

The IBC and NFPA 101 recognize two approaches to address mixed uses. Occupancy separations may or may not be required between any two occupancies in a building of mixed occupancy depending on the separation approach taken. In addition, some specific use areas are required to be separated regardless of the approach chosen to address a mixed occupancy building.

The Cumberland County Civic Center will use the un-separated mixed use approach. The un-separated mixed use approach, found in Section 508.3.2 of the IBC and Section 6.1.14 of the NFPA 101, requires that the building construction and fire protection comply with the most restrictive, un-separated occupancy classification.

The following areas are also separated using this approach:

OCCUPANCY/SPECIFIC HAZARD	IBC REQUIRED FIRE RESISTANCE RATING	NFPA 101
Electrical Transformer Room (Containing >112.5 kVA Dry-Type Transformer)	1-hour (NEC Section 450-21)	1-hour (NEC Section 450-21)
Fire Department Command Center (Room & Access to)	1-hour (Section 911.1)	1-hour NFPA 1 Section 11.9.2
Boiler Rooms	>15 psi and 10 hp Smoke Tight Construction (Section 508.2.5)	>200,000 Btu aggregate in room Smoke Partition Section 12.3.2
Generator Room	1-hour (Section 909.11)	2-hour NFPA 110 Section 7.2.1.1
Fire Pump Room	2-hour (Section 508.2.5)	2-hour with access approved by Fire Department NFPA 20 Section 5.12.1.1

5.2 FIRE-RESISTIVE CONSTRUCTION

The construction classification of the Cumberland County Civic Center is assumed to meet Type I-B (IBC) and Type II-222 (NFPA 101), per Table 602 of the IBC and Section 12.1.6 of the NFPA 101. New construction for the building will be required to meet the following parameters:

BUILDING ELEMENT	FIRE-RESISTANCE RATING
Exterior load-bearing walls	2-hour
Interior bearing structural members (columns, partitions, walls, etc.)	2-hour
	2-hour, if supporting roof only
Floors	2-hour
Roofs	1-hour; 0-hour where the lowest portion of the roof structure is 20 feet or more above the floor
Exit access corridors & Concourse	0-hour
Enclosed vertical shafts (including Type I grease duct enclosure) & exit enclosures	2-hour

Fire rated doors, frames, and hardware will be provided on openings in rated separations and vertical shafts. Doors will be self-closing or automatic closing.

- ¾-hour doors in 1-hour walls which are not shafts or exits
- 1½-hour doors in 2-hour enclosures and fire wall; doors at stair enclosures do not need to meet the additional temperature transmission criteria of a maximum of 450° F at the end of a 30-minute fire exposure in sprinklered buildings

5.2.3 Interior Finish

LOCATION	INTERIOR FINISH RATING IBC CHAPTER 8	INTERIOR FINISH RATING NFPA 101 SECTION 12.3.3
Stair enclosures	Class A or B	Class A or B
Corridors & lobbies	Class A or B	Class A or B
Assembly areas greater than 300 occupants	Class A or B	Class A or B
Other areas including offices & assembly less than 300 occupants	Class A, B, or C	Class A, B, or C

5.3 EXITING SYSTEMS

The building will be evaluated using both smoke protected assembly seating and traditional exiting philosophies. The building is fully sprinklered. Exits will be sized accordingly.

All areas will employ traditional exit factors until they enter a smoke protected area. At that point, the smoke protected provisions will be applied to the population. If smoke protected areas exit through areas where traditional exiting factors apply, the traditional exiting factors will apply to the entire population exiting through that area.

Traditional Exit Width Factors:

- Stairs, aisles — 0.3 inches/person (40 people/foot)
- Doors, ramps, Concourses — 0.2 inches/person (60 people/foot)

The Seating Bowl and Main Concourse will be evaluated using smoke protected assembly seating philosophies. Exits will be sized based on the smoke protected assembly seating provisions as allowed per Section 1028 of the IBC and Section 12.4.2.3 of the NFPA 101. The use of smoke protected assembly seating concepts allows the following exit width factors:

Smoke Protected Exit Width Factors:

- Stairs, Aisles — 0.144 inches/person (83 people/foot)
- Doors, Ramps, Concourses — 0.11 inches/person (109 people/foot)

5.3.1 Main Exit

For assembly occupancies, if a main entrance is provided, it is required to serve 50% of the population.

5.4 SMOKE MANAGEMENT SYSTEM

A mechanical smoke control system will be provided to allow the use of smoke-protected assembly seating provisions. When activated, the smoke control system will exhaust smoke from the seating bowl or concourse at a rate which maintains the smoke layer six feet above the floor.

5.5 FIRE SUPPRESSION SYSTEMS

5.5.1 Automatic Sprinklers and Standpipes

5.5.1.1 Sprinklers

- Sprinklers are required throughout all enclosed spaces per NFPA 13, 2010 Edition.

5.5.1.2 Standpipe Risers

- Required per IBC Section 905.3.19 and NFPA 1 Section 13.2.2
- Provide wet automatic Class I standpipes with 2½ inch outlets in all exit stairways per the IBC Section 905.3.2.

  In exterior areas or non-conditioned interior areas subject to freezing, provide dry standpipes per IBC Section 905.3.2.

5.5.1.3 Water Supply

- Connection to the public water supply.

5.5.2 Provide Portable Fire Extinguishers

- Portable fire extinguishers are required per NFPA 1 Section 13.6.2.
- Drawings are required to show type and mounting locations.

5.5.3 Automatic Extinguishing Systems Serve All Grease Laden Cooking Hoods

- Required to comply with Section 12.7.2 of the NFPA 101, Chapter 50 of NFPA 1 and NFPA 96

5.6 FIRE DETECTION SYSTEMS

5.6.1 Automatic fire alarm systems required to monitor:

a. Automatic sprinkler waterflow alarms.
b. Smoke detectors in elevator lobbies, top of freight elevator shafts, and elevator machine rooms to initiate elevator recall.
c. Smoke detectors within HVAC supply air ducts with fan capacities in excess of 2,000 cfm and return air ducts with fan capacities in excess of 15,000 cfm. Smoke detection within these ducts shall initiate automatic fan shutoff.
d. Smoke detectors at locations that have fire alarm system control equipment. These areas include, but are not limited to, transponders, power supply panels, and control panels.
e. Beam detectors which activate the smoke control system.

5.6.2 Manual

- One manual pull station is required.

5.6.3 Fire Alarm Equipment required to comply with NFPA 101, NFPA 1, and City of Portland Fire Department Rules and Regulations.

5.7 EMERGENCY ALARM AND COMMUNICATIONS SYSTEMS

Provide combination audio/visual devices throughout all areas of the building. A voice alarm and strobes are required. Occupant notification will be by voice announcements and visual appliances per Section 907.2.1.1 of the IBC and Section 12.3.4.3 of the NFPA 101. Use of the PA system for audible notification in accordance with Section 12.3.4.3.6 of the NFPA 101 is allowed.

Supervision per City of Portland Fire Department Rules and Regulations, NFPA 72, and other applicable codes:

a. Fire detection and alarm system provided with trouble alarm signals.
b. Sprinkler and standpipe systems including:
    - Valve tamper switches on all water supply control valves.
    - Waterflow switches for each system.
c. Fire alarm annunciation panel provided at Spring Street and Free Street entrances.

Upon alarm activation, all performance sound equipment circuits will initiate shunt trip and lighting will be restored to normal levels.

5.8 SECONDARY POWER

5.8.1 Emergency power (as defined by NFPA 70) is required for the following connected loads simultaneously:

- Fire Detection and Alarm Systems
- Exit and Emergency Lighting
- Voice/Alarm Communication System
- In-Building Public Safety Radio Enhancement System if required

5.8.2 Standby power (as defined by NFPA 70) is provided for the following connected loads simultaneously by an emergency generator:

- Elevators that connect four stories or are listed for accessible means of egress
- Smoke Control System
- Fire Pump (if provided)

5.9 FIRE FIGHTING ACCESS AND FACILITIES

5.9.1 Alarms automatically relayed via central alarm station to fire department. AES Master Box Connect will be provided per City of Portland Fire Department Rules and Regulations.

5.9.2 Sprinkler systems provided throughout the building.

- Fire department connection provided per NFPA 13 and 14 in an accessible location approved by the Fire Department, near the front entry point of the building. Recommended locations are on the Spring Street and Free Street sides of the building.

5.9.3 Fire apparatus access roads are required to be within 150 feet of all exterior portions of the First Level.

5.9.4 Emergency Responder Radio Coverage

Emergency responder radio coverage is required per IBC Section 915. In addition, a central control system consolidated in a fire command center is required to be provided for the Fire Department which contains fire alarm panels, controls for the voice alarm system, two-way communication systems (if required), elevator status panels, emergency generator status panels, fire pump status panels and a public telephone. An RF Engineer will determine compliance with NFPA 1 Annex O for performance of the public safety radio system within the building.

5.9.5 Fire Command Center

The following are required in a Fire Command Center, per IBC Section 911 and NFPA 1 Section 11.9:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire-fighter's control panel required by IBC Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking stairway doors simultaneously.
8. Sprinkler valve and waterflow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighting equipment and fire department access and the location of fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.
13. Work table.
14. Generator supervision devices, manual start and transfer features.
15. Public address system, where specifically required by other sections of this code.
16. Elevator fire recall switch in accordance with ASME A17.1.
17. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.

5.9.6 Shaftway Markings

- Exterior access – Outside openings accessible to the fire department that open directly on a hoistway or a shaftway communicating between two or more floors are to be marked "shaftway" in red letters at least six inches high on a white background.
- Interior Access – Interior door or window openings to a hoistway are to be plainly marked "shaftway" in red letters at least six inches high on a white background.
  - Exception: Markings are not required if the opening to the shaft is readily discernable as an opening by the construction or arrangement.
- Per IBC Section 914.1 and NFPA 1 Section 10.12.2

5.9.7 Equipment Room Identification

- Rooms containing controls for air conditioning systems.
- Rooms with sprinkler riser valves or other fire detection, suppression, or control elements.
- Per IBC Section 914.2, NFPA 101, NFPA 1, and City of Portland Fire Department Rules and Regulations.

FP&C CONSULTANTS, INC.

Smoke Control Report

Project No. 7657.00

October 16, 2012

CUMBERLAND COUNTY CIVIC CENTER

PORTLAND, MAINE

WBRC Architects & Engineers
30 Danforth Street, Suite 306
Portland, Maine 04101
(207) 947-4511

STATE OF MAINE
DONALD C. BIRCHLER
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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

PURPOSE

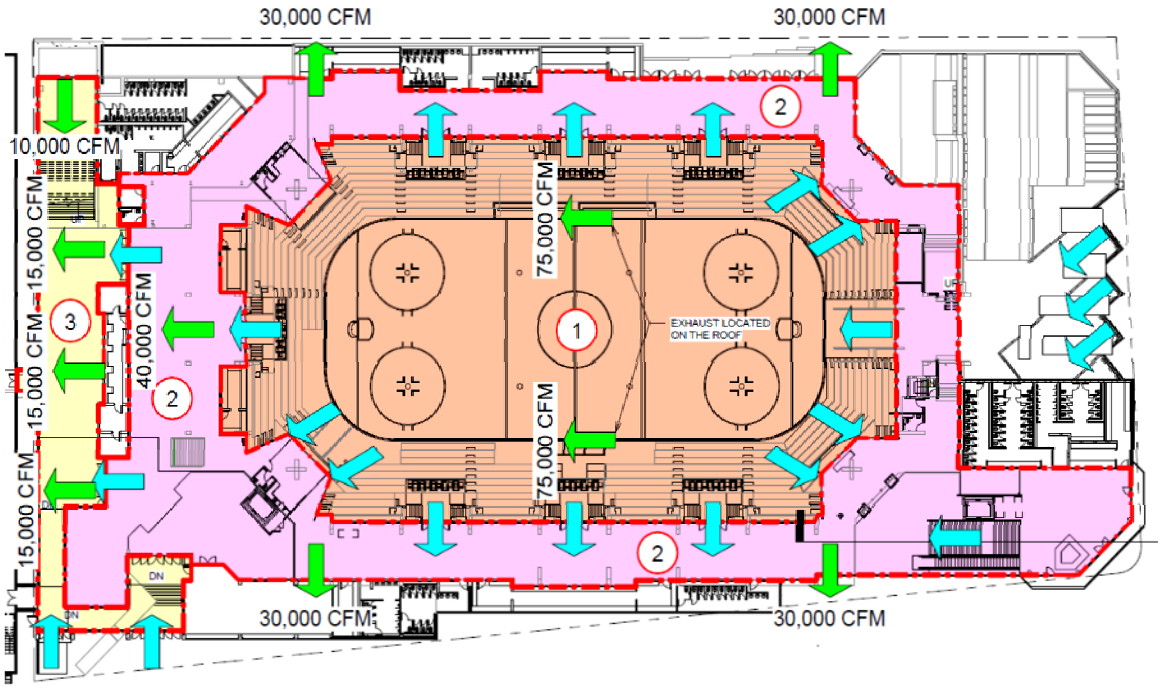
A mechanical smoke control system is required in order to allow the use of smoke-protected assembly seating provisions in the Cumberland County Civic Center. The purpose of the mechanical smoke control system in the Cumberland County Civic Center is to control the accumulation of smoke in the West Lobby, the Seating Bowl, the Main Concourse, and the Mechanical Level Lobby in order to maintain tenable conditions six feet above the highest level of egress in the active smoke control zone in order to allow Arena occupants to exit in accordance with Section 909.8.1 of the 2009 Maine Uniform Building and Energy Code (MUBEC) [an amended 2009 International Building Code (IBC)] and Section 12.4.2.1 (2) (a) of the 2009 Edition *Life Safety Code* (NFPA 101). The proposed smoke control system is designed to achieve these objectives. The proposed mechanical smoke control system will consist of three (3) smoke control zones that encompass the Lobby, the Seating Bowl, and the Main Concourse (which includes a portion of the Mechanical Level that is considered a communicating space in accordance with Section 8.6.6 of the 2009 Edition of NFPA 101) of the Cumberland County Civic Center.

METHODOLOGY

Mechanical Smoke Exhaust

The smoke control system proposed for the Arena achieves the design objectives by way of mechanical exhaust vents designed to operate in each zone of the Arena. A total of eleven (11) mechanical exhaust fans were modeled in the Arena. Please see Figure 1.1 below which provides a plan view illustration of the modeled location of the smoke exhaust fans.

Figure 1.1
Cumberland County Civic Center Modeled Smoke Exhaust Fan Locations



The system was modeled to activate either by beam detectors or automatic sprinklers in the Arena. The beam detectors were essential for proper system operation for a fire in the Seating Bowl of the Arena (an axisymmetric smoke plume design fire scenario). Automatic sprinklers were the primary method of system activation for the design fire scenarios at the Mechanical Level Lobby (a balcony spill plume design fire scenario) and on the Main Concourse (an axisymmetric smoke plume design fire scenario). See Table 1.1 below for the different exhaust fan sizes that were modeled in the Arena (see Figure 1.1 above and the illustrations outlined in Table 1.3 to reference modeled fan locations). Fan sizes given in this report are to be considered the minimum required fan sizes. Reverse stack effect pressure differentials should be considered by the mechanical designer (see Section 3.13.1 of this report for more detail).

Table 1.1
Cumberland County Civic Center Modeled Smoke Exhaust Fan Sizes

SMOKE CONTROL ZONE (FAN LOCATION)	QUANTITY OF FANS	MINIMUM FAN SIZE EACH FAN (CFM)	TOTAL MINIMUM EXHAUST REQUIRED (CFM)
Seating Bowl Zone	2	75,000	150,000
Main Concourse / Mechanical	5	30,000 [a] / 40,000 [b]	160,000
West Lobby & Stairs	4	15,000 [c] / 10,000 [d]	55,000

[a] *The north Main Concourse and the south Main Concourse both require two (2) 30,000 cfm fans each (placed at opposite ends of the concourse)*
[b] *The west Main Concourse requires one (1) 40,000 cfm fan*
[c] *The west Lobby requires three (3) 15,000 cfm fans*
[d] *The west Lobby stairs require one (1) 10,000 cfm fan*

Table 1.2
Cumberland County Civic Center Smoke Control System Activation Mechanisms

SMOKE CONTROL ZONE (FAN LOCATION)	SMOKE CONTROL SYSTEM ACTIVATION MECHANISM(S)
Seating Bowl Zone	Beam Detectors / Manual Control / Automatic Sprinklers
Main Concourse / Mechanical	Automatic Sprinklers / Spot Smoke Detectors [a] / Manual Control
West Lobby & Stairs	Automatic Sprinklers / Spot Smoke Detectors [b] / Manual Control

[a] *Spot smoke detectors were used for primary activation on the Mechanical Level Lobby (automatic sprinklers also present)*
[b] *Spot smoke were used for primary activation in the West Lobby (automatic sprinklers also present)*

Naturally Supplied Make-up Air

Make-up air for the smoke control system will be supplied through natural ventilation provided by overhead doors in the loading dock on the east end of the building and exterior doors that were modeled to open automatically upon system actuation. A sign is recommended in the vicinity of these doors that communicates that these doors are part of the smoke control system and need to be kept in working order. Make-up air will travel from the loading dock through the Seating Bowl and from the exterior doors into other areas of the building. The illustrations outlined in Table 1.3 below represent the make-up air supply plan. The following provides a brief summary of how make-up air will be supplied to each smoke control zone:

1. West Lobby Smoke Control Zone: Make-up air will enter the Seating Bowl through the east Event Level vomitory from the loading docks. Make-up air will then be transferred to the Main Concourse through the openings on the northeast, southeast, and southwest ends of the Seating Bowl. Make-up air will be supplied to the West Lobby from two doors on automatic openers that connect the Main Concourse and the West Lobby (which will in turn be supplied through the Seating Bowl openings). Make-up air will also be provided by doors on automatic openers on the southwest Main Concourse Level and the southeast Mechanical Level.

2. Seating Bowl Smoke Control Zone: Make-up air will enter the Seating Bowl through the east Event Level vomitory from the loading docks. Make-up air will also be provided by doors on automatic openers on the southwest Main Concourse Level and the southeast Mechanical Level.

3. Main Concourse Smoke Control Zone: Make-up air will enter the Seating Bowl through the east Event Level vomitory from the loading docks. Make-up air will then be transferred to the Main Concourse through the openings on the northeast, southeast, and southwest ends of the Seating Bowl as well as from the doors on automatic openers in the vomitories. Make-up air will also be provided by doors on automatic openers on the southwest Main Concourse Level and the southeast Mechanical Level.

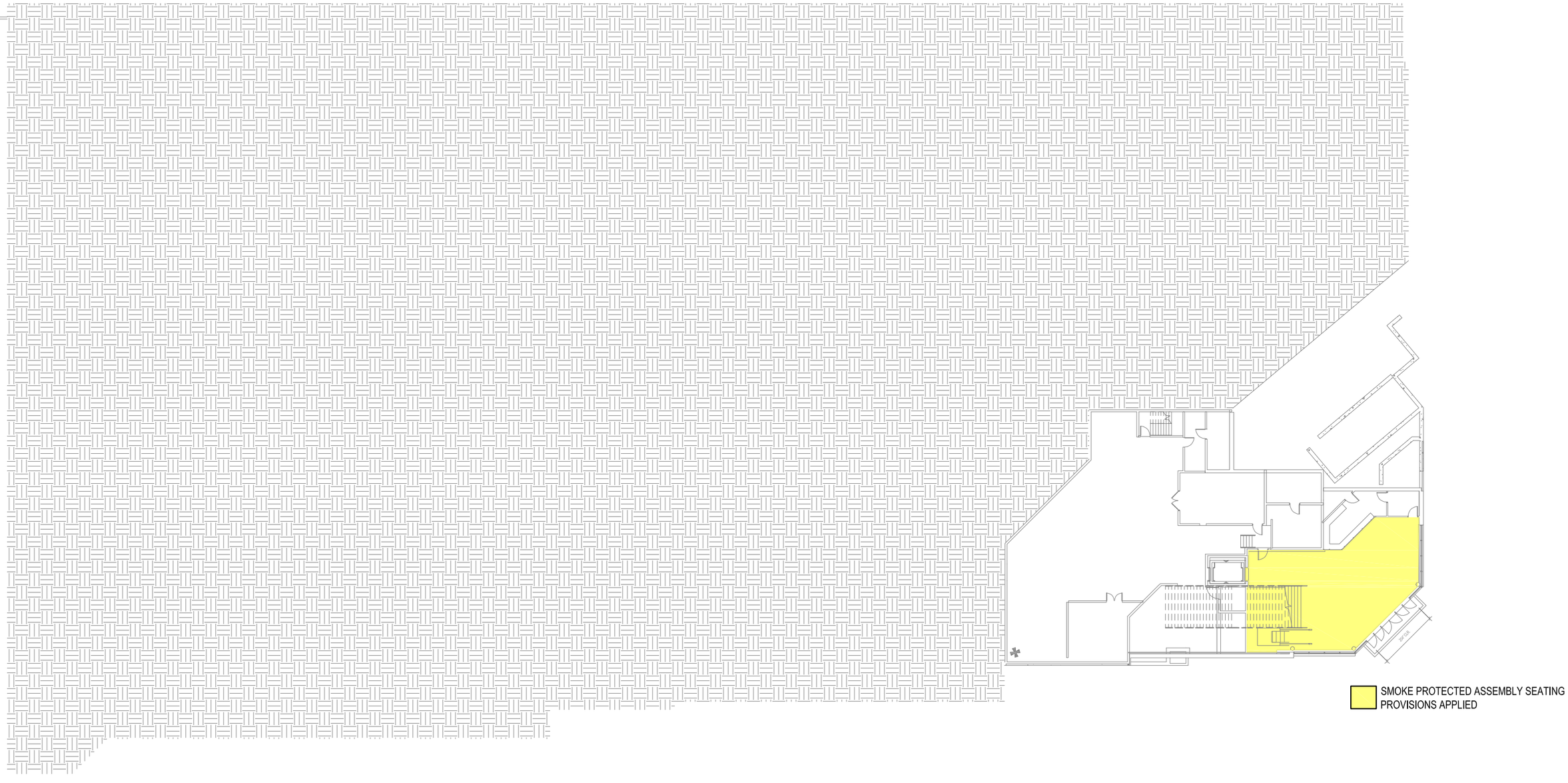
DESIGN

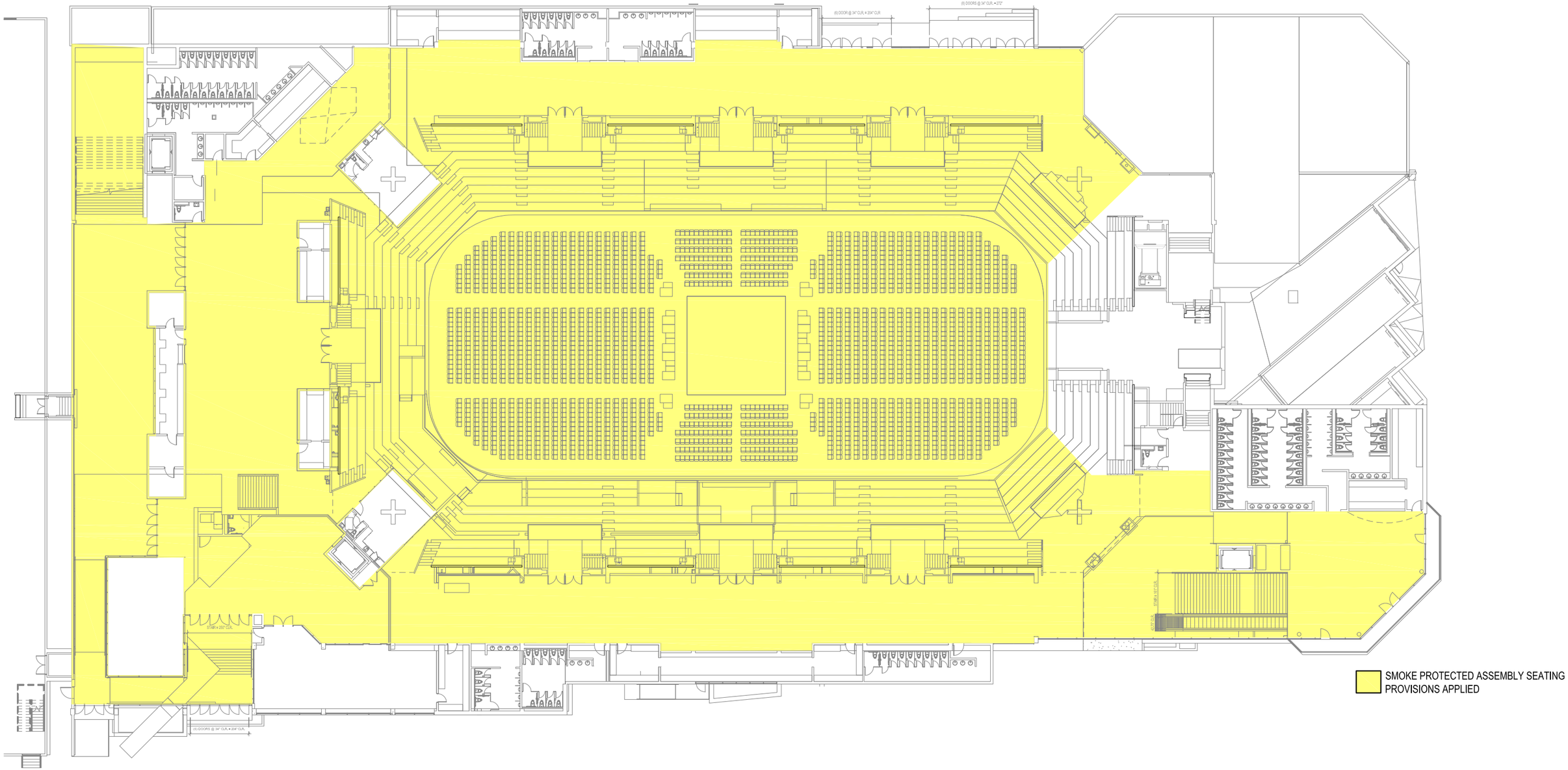
The smoke control system was designed using a *computational fluid dynamics* (CFD) fire model called *Fire Dynamics Simulator* (FDS). The FDS software, developed by the *National Institute of Standards and Technology* (NIST), was considered the best software for modeling the evolving distribution of smoke, fire gases, and temperature in the Arena during smoke exhaust fan operation in order to determine if tenable conditions were maintained six feet above the highest level of egress in the active smoke control zone. The parameters used for the fire modeling were based on the 2009 MUBEC and the 2009 Edition of NFPA 101.

Please see the illustrations on the following pages (outlined in Table 1.3 below) for system details:

Table 1.3
Illustrations Depicting Mechanical Smoke Control Requirements for the Cumberland County Civic Center

ILLUSTRATION	DESCRIPTION
SM.001-003	Plan views of Cumberland County Civic Center that depict: 1. Smoke protected areas.
IL.001-005	Plan views of Cumberland County Civic Center that depict: 1. Smoke control zones. 2. Proposed locations of mechanical exhaust. 3. Proposed locations of make-up air by doors on automatic openers. 4. Flow of make-up air through smoke control zones.





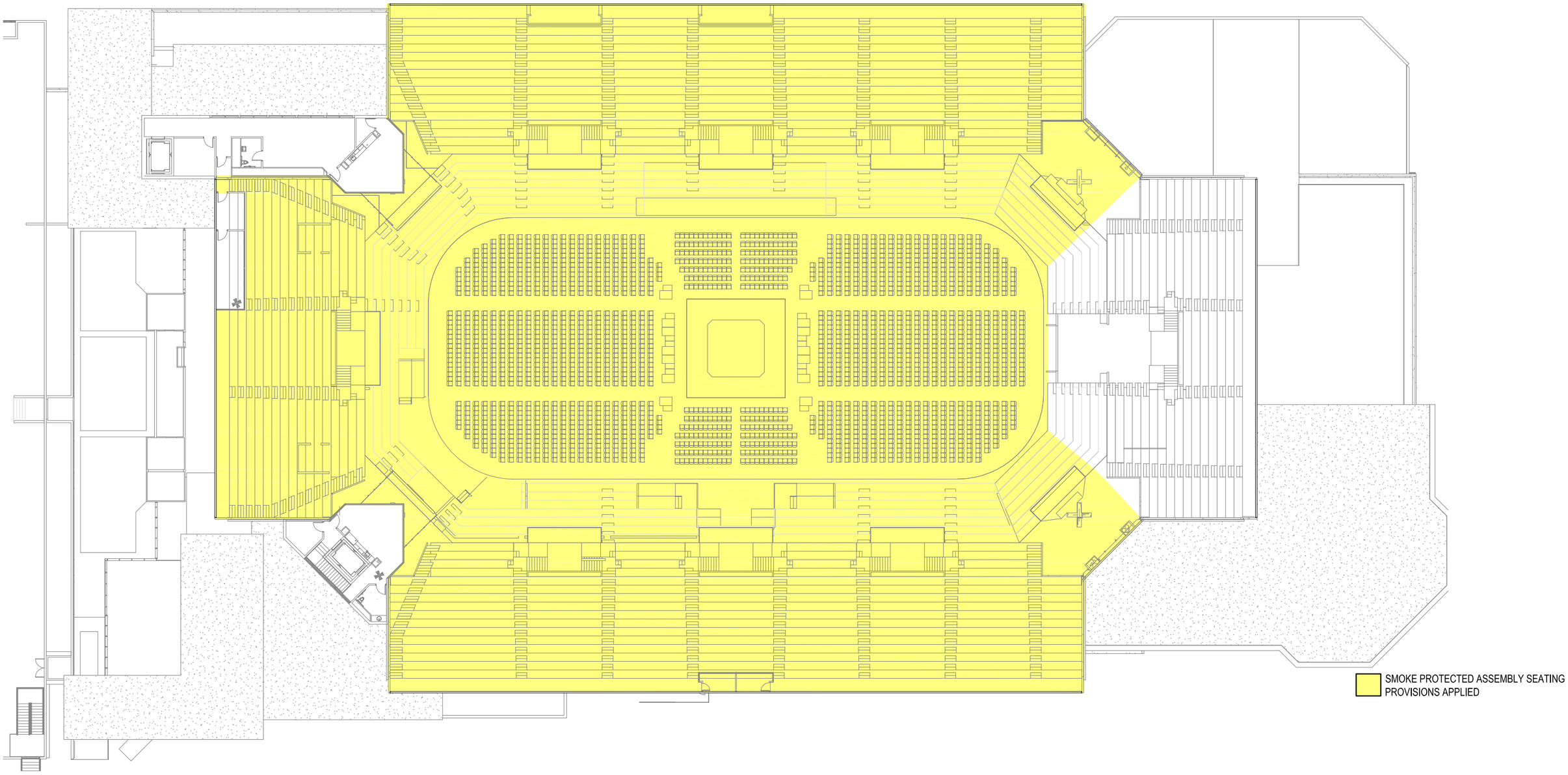
FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

NORTH

CONCOURSE LEVEL

SMOKE PROTECTED AREAS

SM.020



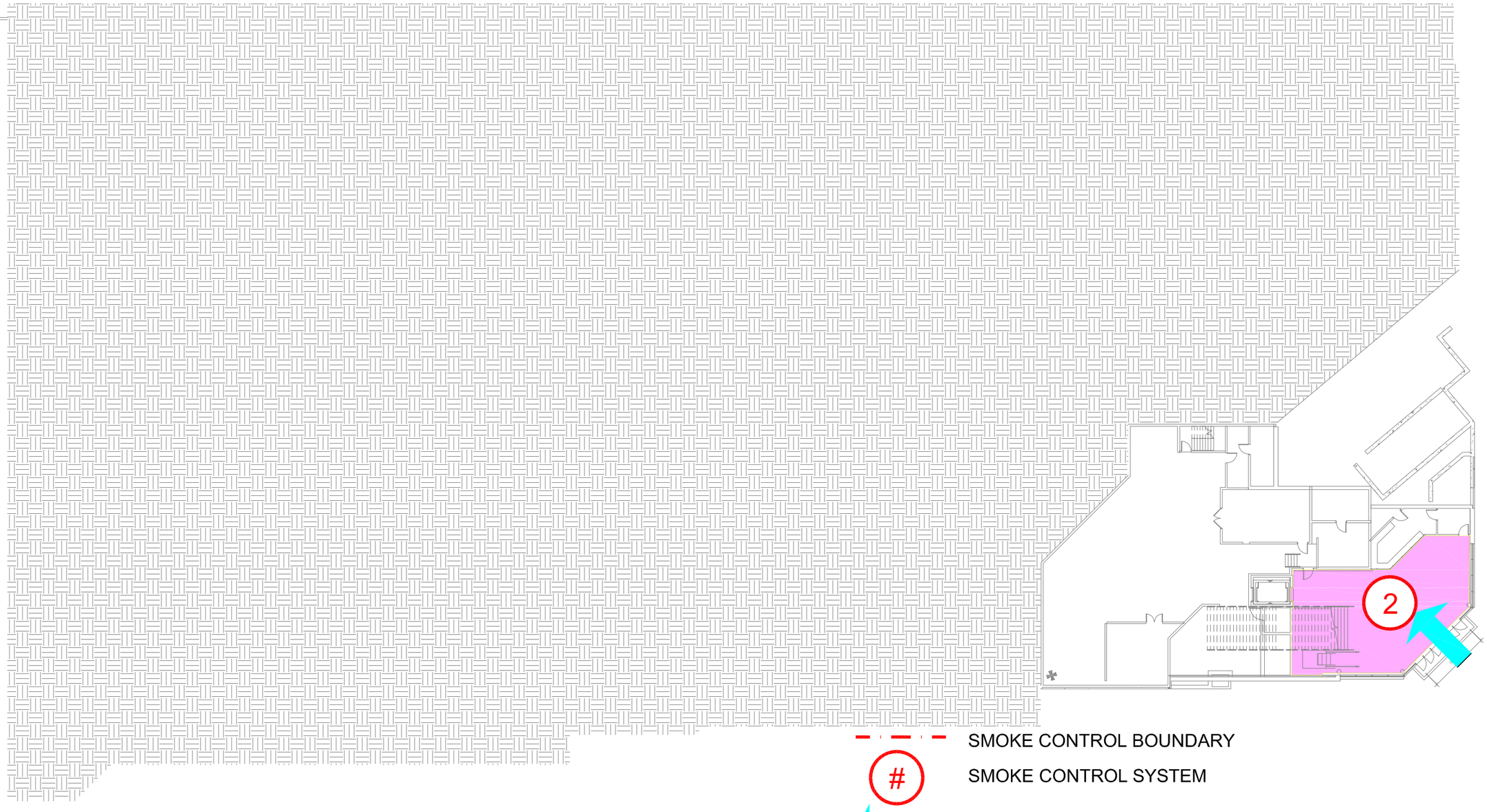
FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

NORTH

UPPER SUITE LEVEL

SMOKE PROTECTED AREAS

SM.040



SMOKE CONTROL BOUNDARY

\# SMOKE CONTROL SYSTEM

MAKE UP AIR

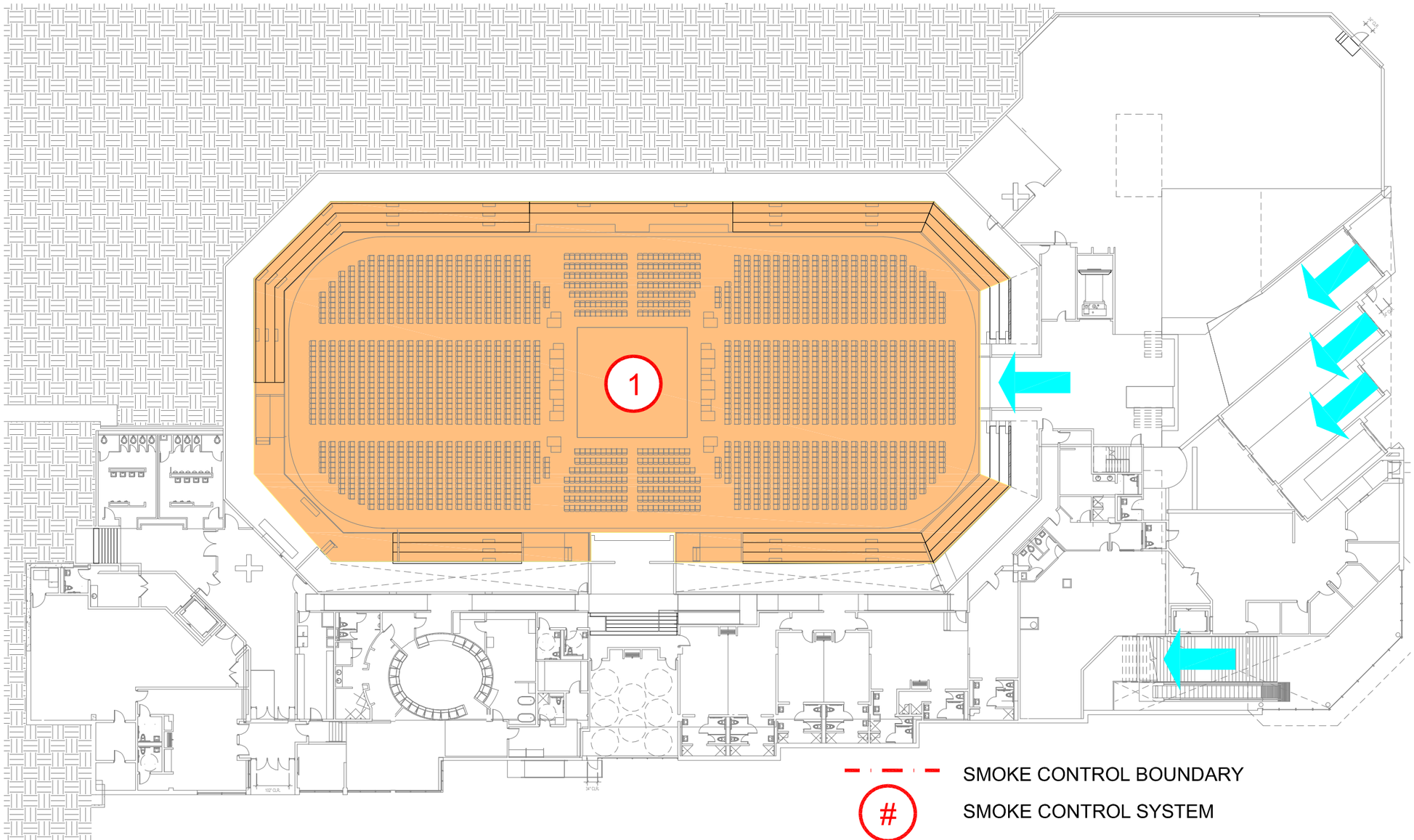
EXHAUST VENTS

NORTH

MECHANICAL LEVEL

FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

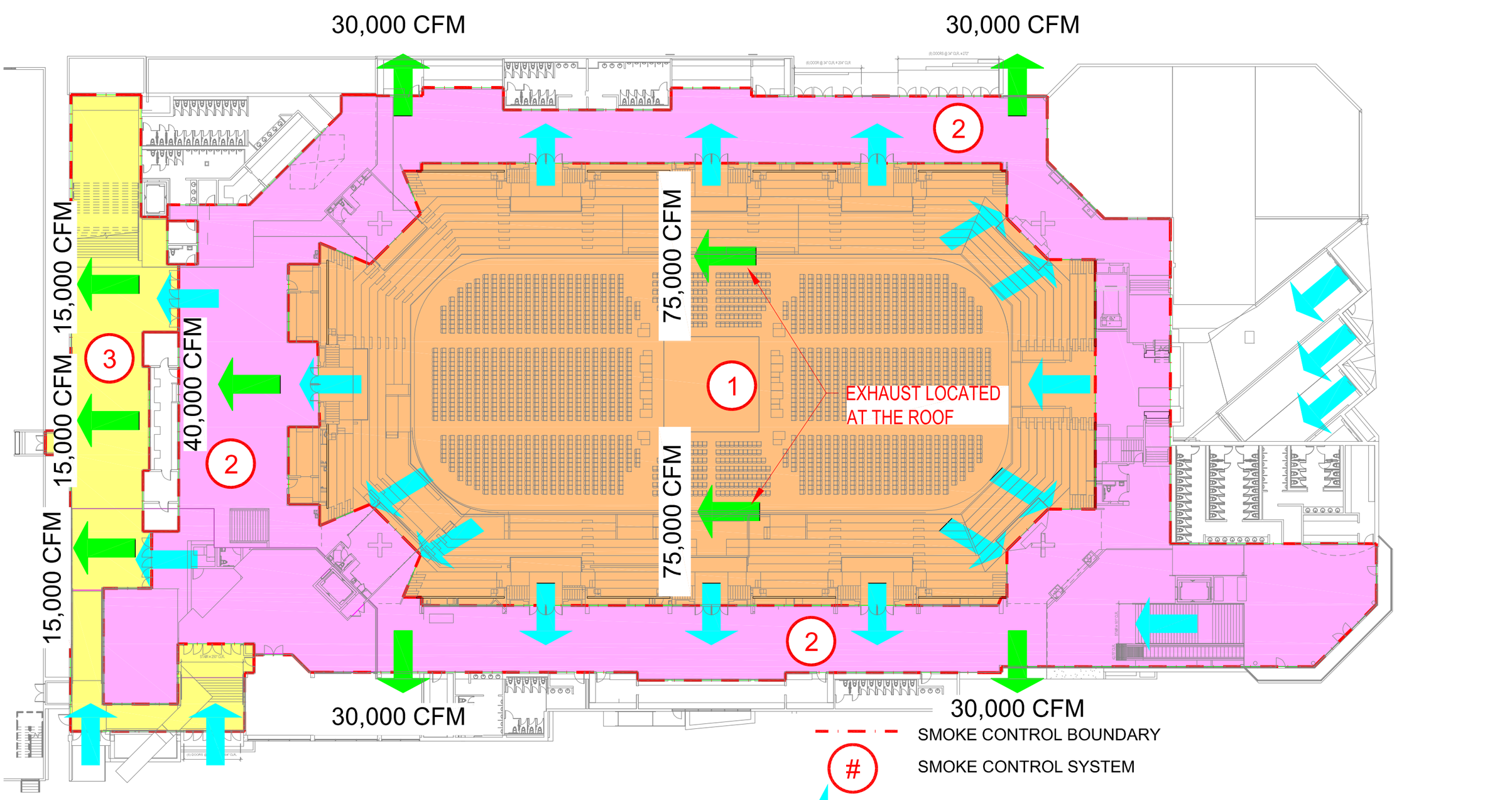
IL.001



EVENT LEVEL

FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

IL.002

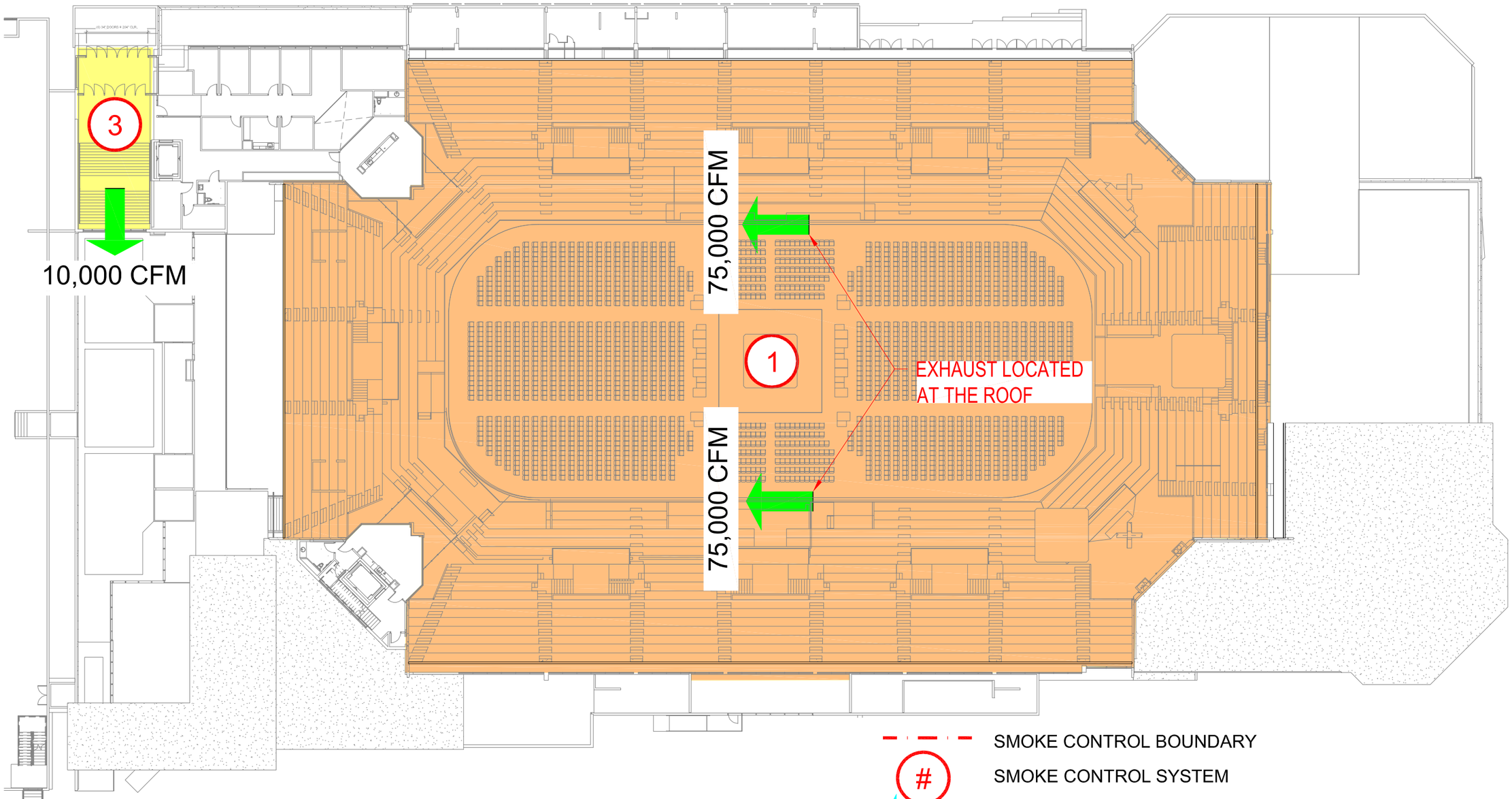


FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

CONCOURSE LEVEL

IL.003

PLOT: RICHARD BRUCE October 12, 2012 11:19 AM 3'-0 67/256" = 1'-0" COLOR1700.CTB (LAYOUT: IL.003)
RICHARDB Friday, October 12, 2012 P:\ACTIVE PROJECTS\7657\00 CUMBERLAND COUNTY CIVIC CENTER RENOVATION\CAD\CURRENT\ILIL.003.DWG



SMOKE CONTROL BOUNDARY

\# SMOKE CONTROL SYSTEM

MAKE UP AIR

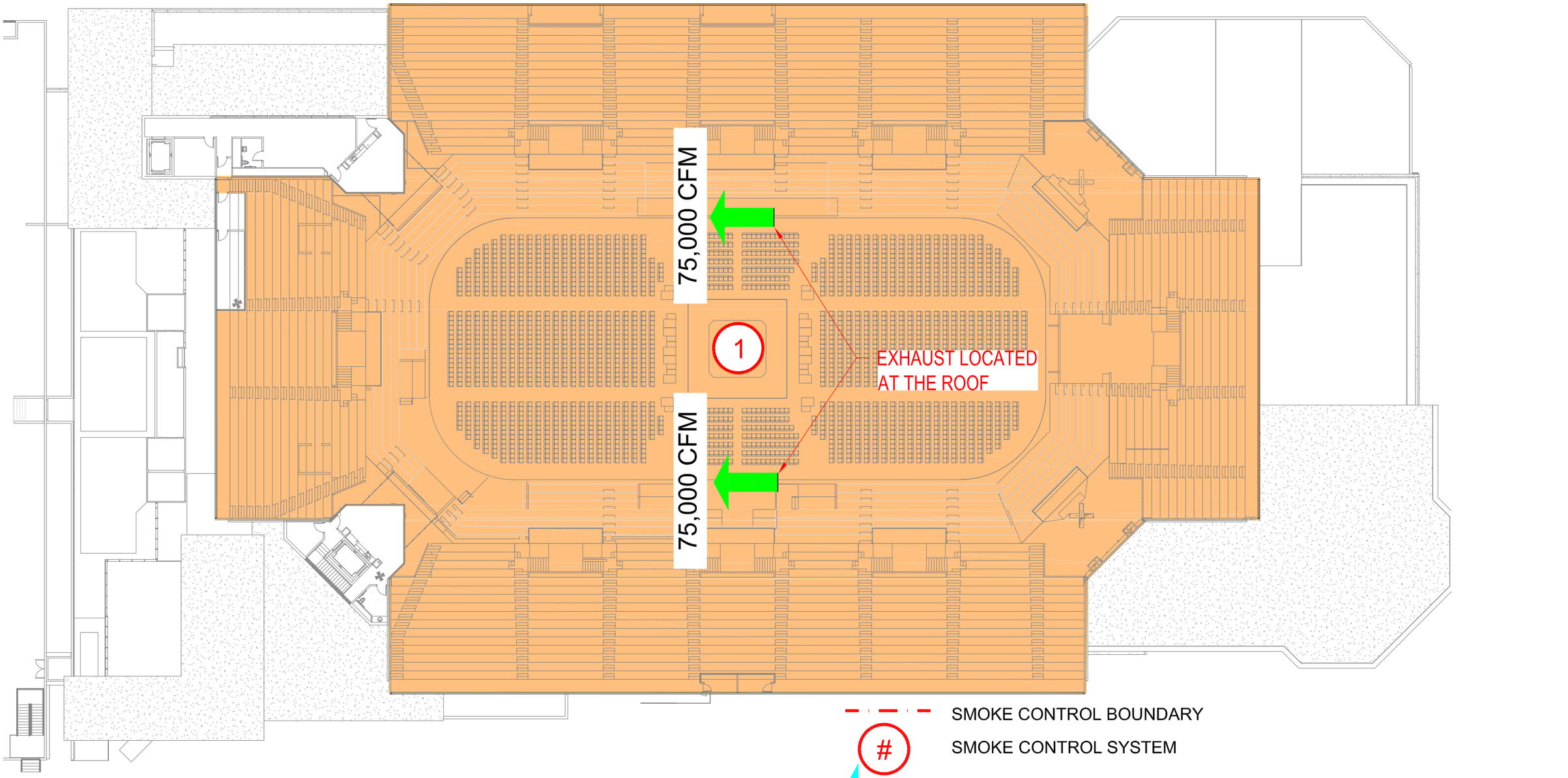
EXHAUST VENTS

NORTH

MID SUITES LEVEL

FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

IL.004



UPPER SUITE LEVEL

2.0 REQUIREMENTS

The following requirements for the smoke control system in the Cumberland County Civic Center are referenced from the 2009 MUBEC that has been adopted by the State of Maine and City of Portland.

2.1 The smoke control system is required to be supplied with two sources of power per Section 909.11 of the 2009 MUBEC. The smoke control system includes all components involved in proper operation of the system to include (but are not limited to) the exhaust fans, dampers, make-up air supply points (all doors on automatic openers in this case), and alarms panels. Primary power will come from the normal building power system. Secondary power is reportedly from a standby generator. The 2008 Edition *National Electrical Code* (NFPA 70) requires standby power systems to be provided with at least 2 hours of run time (for generators powered by internal combustion engines described in Section 701.11 [B]). Note that this required standby power supply time exceeds the duration of operation for the smoke control system required by Section 909.4.6 of the 2009 MUBEC (egress time or 20 minutes, whichever is less) and thus ensures the duration of operation will protect both the means of egress for occupants as well as follow on fire fighter operations.

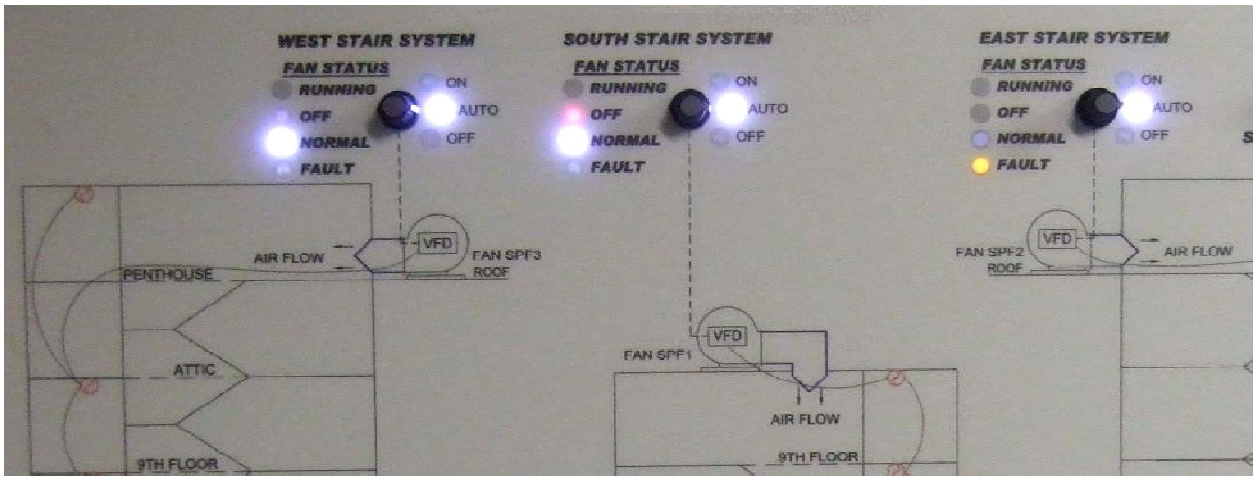
2.2 A Firefighter's Smoke Control Panel is required per Section 911.1.5 (6) of the 2009 MUBEC and must conform to the specifications set forth in Section 909.16 of the 2009 MUBEC. Section 911 of the 2009 MUBEC requires the panel to be installed in a Fire Command Center if using smoke-protected assembly seating or in an approved location adjacent to the fire alarm control panel. In general, a Firefighter's Smoke Control Panel should contain the following:

2.2.1 Manual control or override of automatic control for mechanically controlled systems.

2.2.2 Fans within the building should be clearly shown along with the direction of air flow and the relationship of components (usually on a plan or section view diagram). The intent is to allow firefighters and other emergency personnel who are not familiar with the building to quickly gain situational awareness as to the intended function of the smoke control system and if it is indeed properly functioning. The Fire Marshal and Authority Having Jurisdiction (AHJ) will have the final approval on what is displayed on the panel.

2.2.3 Status indicators are required to be provided for all smoke control equipment and comply with the status indicator guidance in Section 909.16.1 of the 2009 MUBEC. Control capability is of these components is further defined in Section 909.16.2 and 909.16.3 of the 2009 MUBEC. Figure 2.1 below provides an example of what these status indicators could look like.

Figure 2.1
Example of a Fire Fighter's Smoke Control Panel
Close Up of Status Indicators and Air Flow Indicators



2.3 All smoke control equipment shall be suitable for the intended use and suitable for the design temperatures indicated in the rational analysis (Section 3.1.4.13 of this report) in accordance with Section 909.10 of the 2009 MUBEC.

2.4 In order to be approved, the smoke control system must be tested in the presence of the AHJ to confirm that the system operates in compliance with all applicable code sections (Section 909.20.4.3 of the 2009 MUBEC).

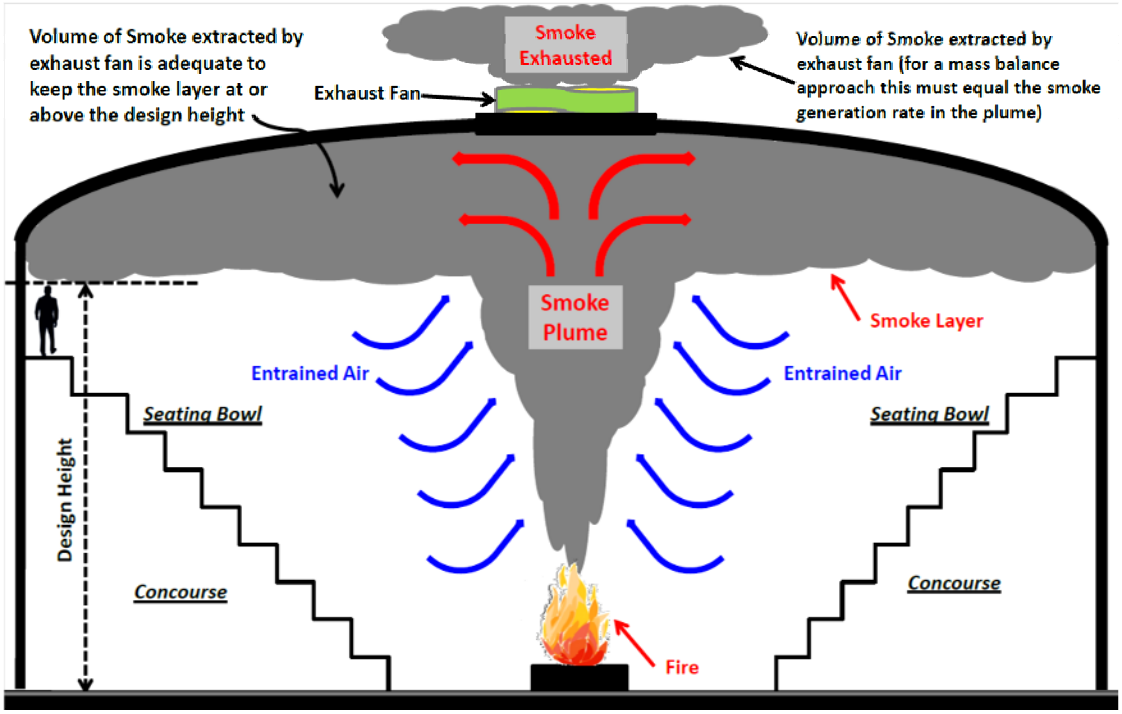
3.0 CUMBERLAND COUNTY CIVIC CENTER ARENA SMOKE CONTROL SYSTEM

3.1 RATIONAL ANALYSIS ASSUMPTIONS

A mechanical smoke control system is required in order to allow the use of smoke-protected assembly seating provisions in the Cumberland County Civic Center in accordance with Section 909.8.1 of the 2009 MUBEC and Section 12.4.2.1 (2) of the 2009 Edition of NFPA 101. The exhaust method was used for the proposed smoke control system in accordance with Section 909.8 of the 2009 MUBEC.

The exhaust method is a mass balance approach. The burning fire introduces mass (products of combustion and entrained air [which constitute smoke]) into the upper smoke layer. The exhaust system is designed to remove mass (smoke) from the smoke layer.

Figure 3.1
Example of a Smoke Control Mass Balance Approach



When the exhaust fan mass removal rate equals the mass generated by the fire, the smoke layer remains at a constant level. When the fire reduces its assumed size by consumption of the fuel package, or if it does not reach its assumed size due to inadequate fuel arrangement or automatic sprinkler activation, the smoke layer will rise above the design level and create even more favorable tenable conditions.

3.1.1 Smoke Control Zones

The Cumberland County Civic Center smoke control system is to be configured with three mechanical smoke control zones that encompass the West Lobby, the Seating Bowl, and the Main Concourse (which includes a portion of the Mechanical Level Lobby that is considered a communicating space in accordance with Section 8.6.6 of the 2009 Edition of NFPA 101). The purpose of the mechanical smoke control system in the Cumberland County Civic Center is to control the accumulation of smoke in the West Lobby, the Seating Bowl, the Main Concourse, and the Mechanical Level Lobby in order to maintain tenable conditions six feet above the highest level of egress in the active smoke control zone in order to allow Arena occupants to exit in accordance with Section 909.8.1 of the 2009 MUBEC and Section 12.4.2.1 (2) (a) of the 2009 Edition of NFPA 101. For further explanation of the tenable limits in the smoke layer, see **Appendix A** of this report.

3.1.1.1 The smoke control system for the Cumberland County Civic Center consists of mechanical exhaust fans in the following zones:

1. West Lobby Smoke Control Zone: A total of four mechanical exhaust fans were modeled in the West Lobby. Three mechanical exhaust fans were modeled at the ceiling of the West Lobby and one mechanical exhaust fan was modeled at the top of the stair that communicates with this space to the north.

2. Seating Bowl Smoke Control Zone: Two mechanical exhaust fans were modeled at the roof of the Seating Bowl.

3. Main Concourse Smoke Control Zone: A total of five mechanical exhaust fans were modeled in the Main Concourse. The north and south Main Concourses each employed two mechanical exhaust fans on the east and west ends. The west Main Concourse employed one mechanical exhaust fan.

The following methods were used to calculate and validate the smoke control system in the Cumberland County Civic Center:

3.1.1.2 The smoke exhaust fan capacities for the Arena smoke control zone were refined using a CFD model provided by NIST called the FDS.

3.1.1.3 The make-up air requirements were designed to be provided by overhead doors in the east loading dock and exterior doors on automatic openers. Make-up air will be supplied to the smoke control zones from these openings to the outside air as follows:

1. West Lobby Smoke Control Zone: Make-up air will enter the Seating Bowl through the east Event Level vomitory from the loading docks. Make-up air will then be transferred to the Main Concourse through the openings on the northeast, southeast, and southwest ends of the Seating Bowl. Make-up air will be supplied to the West Lobby from two doors on automatic openers that connect the Main Concourse and the West Lobby (which will in turn be supplied through the Seating Bowl openings). Make-up air will also be provided by doors on automatic openers on the southwest Main Concourse Level and the southeast Mechanical Level.

2. Seating Bowl Smoke Control Zone: Make-up air will enter the Seating Bowl through the east Event Level vomitory from the loading docks. Make-up air will also be provided by doors on automatic openers on the southwest Main Concourse Level and the southeast Mechanical Level.

3. Main Concourse Smoke Control Zone: Make-up air will enter the Seating Bowl through the east Event Level vomitory from the loading docks. Make-up air will then be transferred to the Main Concourse through the openings on the northeast, southeast, and southwest ends of the Seating Bowl as well as from the doors on automatic openers in the vomitories. Make-up air will also be provided by doors on automatic openers on the southwest Main Concourse Level and the southeast Mechanical Level.

The effectiveness of the make-up air supplied and its affect on the smoke plume was verified using FDS.

3.1.2 Smoke Control System Operation

The Cumberland County Civic Center smoke exhaust mode is activated manually through the Fire Department Fire Fighters Control Panel (FFCP), automatically from a waterflow switch signal from the fire alarm system in the zoned automatic sprinklers, automatically from smoke detectors in the Seating Bowl smoke control zone (beam smoke detection), automatically from smoke detectors in the West Lobby smoke control zone (area smoke detection), or from smoke detectors in the Main Concourse smoke control zone (area smoke detectors at the ceiling of the Mechanical Level lobby). The total time estimated for the system to function was conservatively modeled at 90 seconds. This would allow transmission time from the waterflow switch (or smoke detector) to the fire alarm panel and from the panel to the smoke exhaust fans and make-up air sources. This also includes time for the deactivation of the Cumberland County Civic Center HVAC systems. The smoke exhaust fans in the Cumberland County Civic Center start and operate at scheduled air volume. Overhead doors on automatic openers at the east loading dock are used to provide unconditioned make-up air into the Seating Bowl which is then distributed to the rest of the Arena by doors on automatic openers in the Seating Bowl vomitories and the Lobby.

3.1.3 Maine Uniform Building and Energy Code Requirements

3.1.3.1 Stack Effect

Per Section 909.4.1 of the 2009 MUBEC the stack effect condition was considered for this smoke control system. The mechanical design must account for the worst case pressure differential (reverse stack effect conditions in the summer) that would cause the outside air to work against the exhaust fans. The following explanation and calculations are provided for the mechanical designer in order to demonstrate the potential effect of the stack effect and reverse stack effect conditions.

Any pressure differential between the interior and exterior of the building can affect the calculated required exhaust rate. Local climate temperature extremes and the relatively constant temperature of the interior of the building (70˚ F) can create pressure differentials between the interior and exterior of the building. The mechanical design must account for the worst case pressure differential (reverse stack effect conditions) that would affect the exhaust fan performance along its performance curve. This pressure differential consideration by the mechanical designer will ensure that the exhaust fan can provide the required exhaust under all stack effect and reverse stack effect scenarios.

Internal building temperatures were assumed to be consistent with normal temperature defined in Section 415.2 of the 2009 MUBEC as 70° F (21.1° C). In accordance with equation 3.22a of *Design of Smoke Management Systems* by Klote and Milke, the pressure to be overcome by the smoke exhaust system is calculated below for stack effect and reverse stack effect conditions:

$$\Delta P_{Stack} := K_s \cdot \left(\frac{1}{T_0} - \frac{1}{T_B} \right) \cdot Z$$

ΔP_{Stack} = Stack pressure differential in inches of water column

K_s = 7.64 (Coefficient)

T_0 = Outside air temperature (°R)

T_B = Building air temperature (°R) = 70 °F + 460 = 530 °R [Normal Temperature and Pressure]

Z = Height above the neutral plane (ft)

For summer conditions (reverse stack effect) conditions:

$$\Delta P_{Stack} := 7.64 \cdot \left(\frac{1}{546.8^{o}\ R} - \frac{1}{530^{o}\ R} \right) \cdot 60.67\ ft = -0.03 \text{ inches of water column}$$

ΔP_{Stack} = Stack pressure differential in inches of water column

K_s = 7.64 (Coefficient)

T_0 = 86.8 °F + 460 = 546.8 °R [2009 ASHRAE Fundamentals, Portland, Maine]

T_B = 70 °F + 460 = 530 °R [Normal Temperature and Pressure]

Z = 60.67 feet (conservative assumption - uses entire building height instead of neutral plane)

For winter conditions (stack effect) conditions:

$$\Delta P_{Stack} := 7.64 \cdot \left(\frac{1}{459.7^{o}\ R} - \frac{1}{530^{o}\ R} \right) \cdot 60.67\ ft = 0.13 \text{ inches of water column}$$

ΔP_{Stack} = Stack pressure differential in inches of water column

K_s = 7.64 (Coefficient)

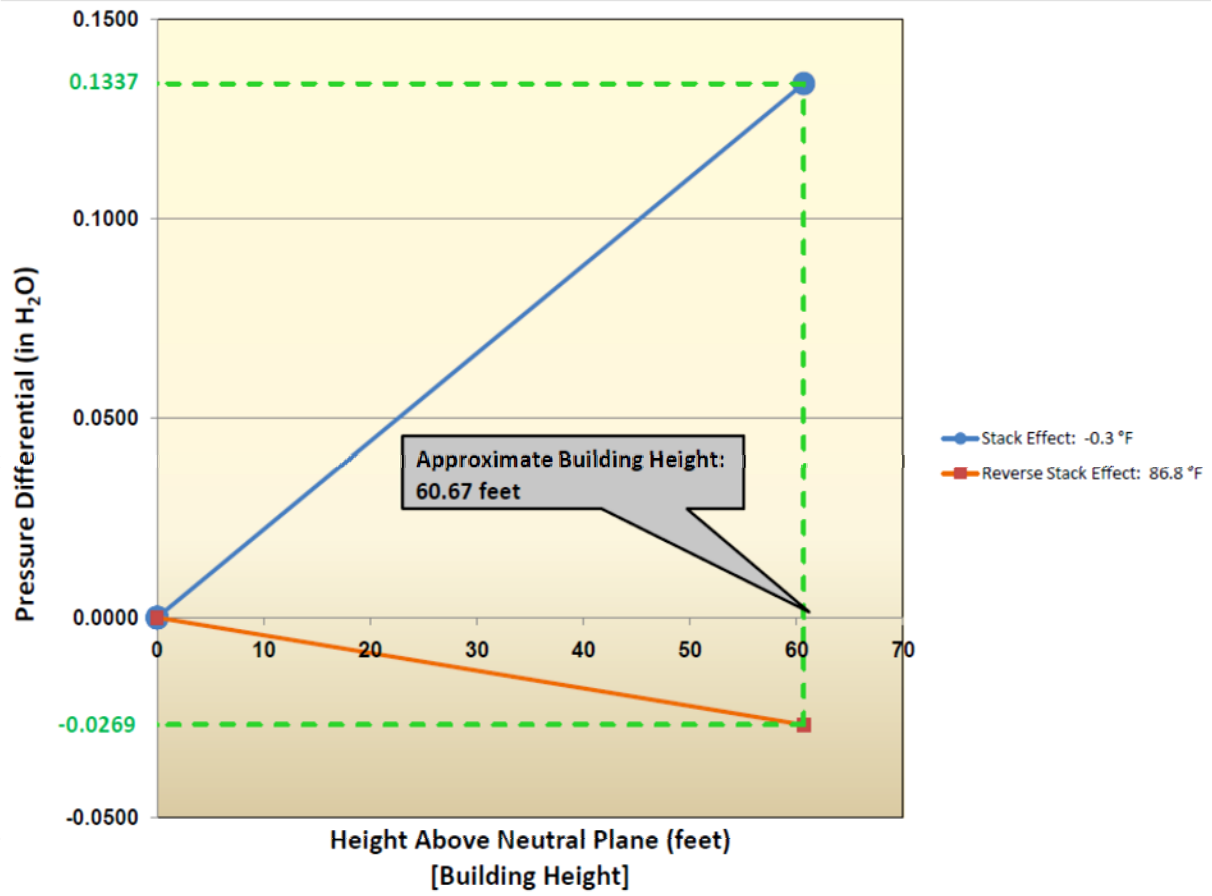
T_0 = -0.3 °F + 460 = 459.7 °R [2009 ASHRAE Fundamentals, Portland, Maine]

T_B = 70 °F + 460 = 530 °R [Normal Temperature and Pressure]

Z = 60.67 feet (conservative assumption - uses entire building height instead of neutral plane)

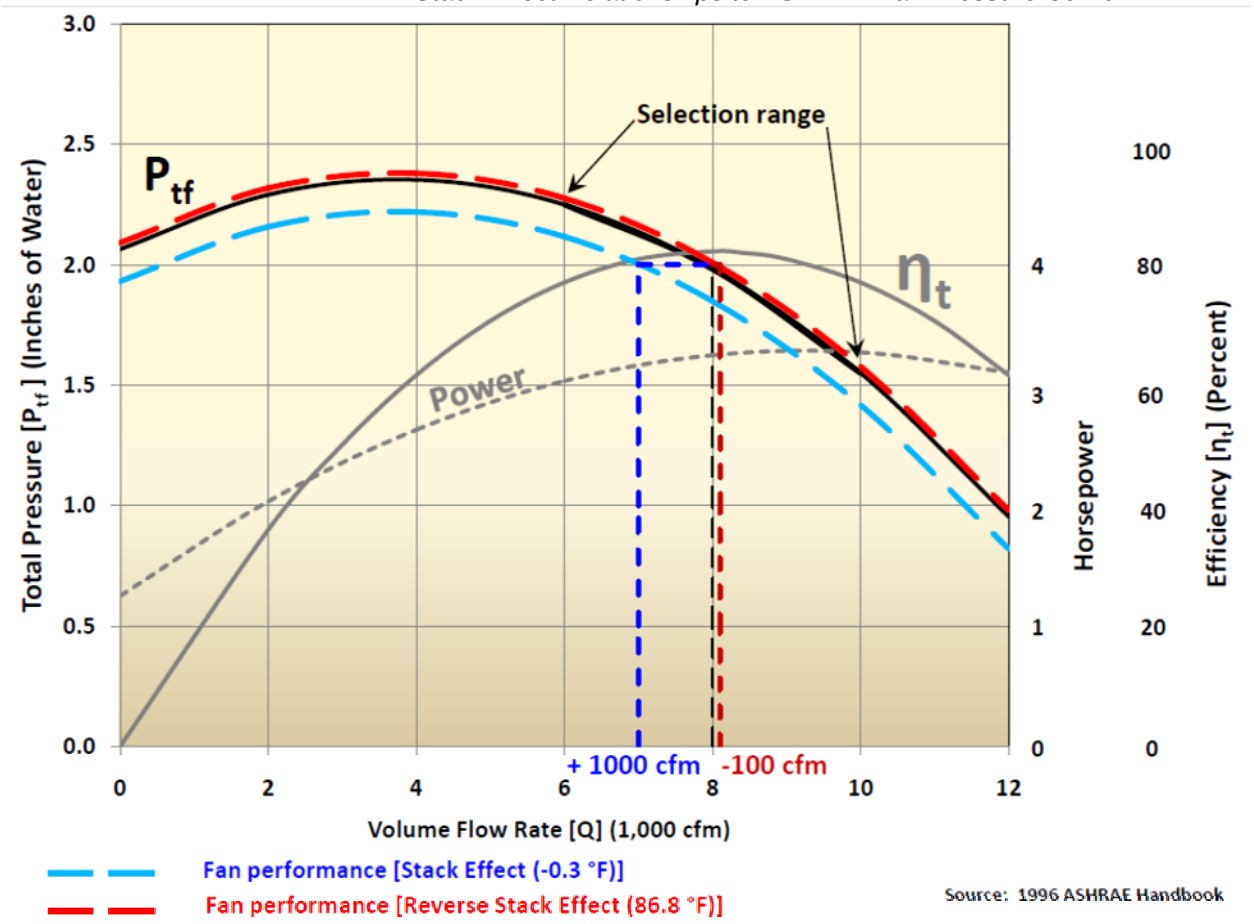
The graph in Figure 3.2 below illustrates the relationship between stack effect as it relates to building height and temperature differential. The values for the calculations above are highlighted on this graph.

Figure 3.2
Stack Effect (2.6° F Low and 97.6° F High)



These pressure differentials are insignificant due primarily to the relatively low overall height of the Arena. The exhaust fans should be able to easily overcome these stack pressures.

Figure 3.3
Stack Effect Relationships to ASHRAE Fan Pressure Curve



The generic fan curve above shows the relationship between stack effect pressure differentials and fan performance.

1. 7,900 cfm performance for reverse stack effect (-100 cfm from 8,000 cfm fan)

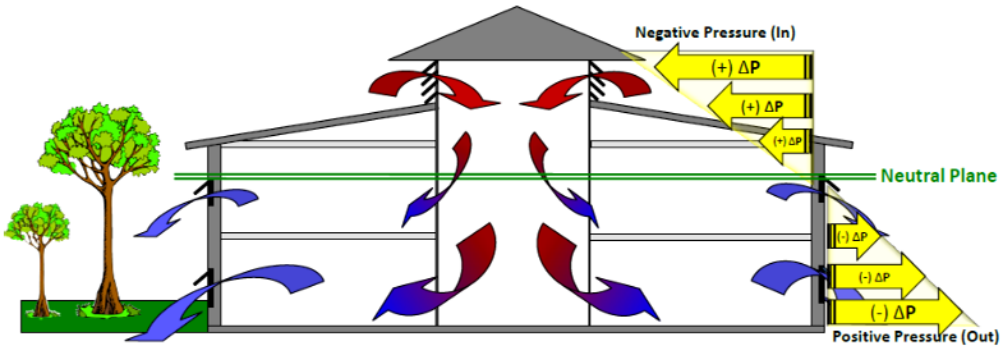
2. 9,000 cfm performance for stack effect (+1,000 cfm to 8,000 cfm fan)

As the example pressure performance curve in Figure 3.3 demonstrates, the worst case scenario occurs in the reverse stack effect condition (summer) which creates a negative pressure differential on the building that the fan must overcome in addition to the exhaust requirements in order to achieve the mass balance for the smoke control system. The pressure of the atmosphere pushing into the building (opposing exhaust during reverse stack effect

conditions) at 60 feet above grade (assuming the exhaust fan was at the roof of the Cumberland County Civic Center) creates a condition where a mechanical fan rated to supply 8,000 cfm of exhaust will only be capable of providing 7,900 cfm of exhaust (according to the example pressure performance curve in Figure 3.3) and would need to provide approximately 100 cfm of additional exhaust capacity (an increase of 1.25%). In this case, these pressure differentials are insignificant and should be easily accounted for by the mechanical designer so that the recommended exhaust capacities are met.

The following diagram (Figure 3.4) illustrates the effects of the negative pressure differential on a building during the reverse stack effect condition. As demonstrated by the calculations above, the positive pressure on the building will require increased fan performance above the calculated design. In order to account for the reverse stack effect condition for the Cumberland County Civic Center, the design fires were modeled by the FDS computational fluid dynamics software using the summer conditions.

Figure 3.4
Reverse Stack Effect Diagram



3.1.3.2 Temperature Effect of Fire

Per Section 909.4.2 of the 2009 MUBEC, the temperature effect of the design fire was accounted for by the CFD fire modeling software called Fire Dynamics Simulator (FDS).

Fire Dynamics Simulator (Computational Fluid Dynamics [CFD] model)

Temperature is a key factor in the fluid dynamics equations that represent the conditions in the Cumberland County Civic Center. FDS will model the effect of the design fire's temperature by simultaneously solving the thousands of fluid dynamics equations that represent the conditions in these spaces.

The FDS software analyzes the effects of the temperature within the calculated smoke layer. As the fire grows, calculated temperature, visibility (optical density of the smoke), and carbon monoxide levels

within the smoke layer and the room are analyzed. See **Appendix A** for more information on these assumed tenability limits.

The temperature of the smoke affects the quantity of exhaust required, since the hotter the smoke is, the more it expands. As it expands, its density decreases (more volume for the same mass). This affects the mass balance calculations, since an exhaust fan's ratings are in cubic feet per minute (cfm), which is a measurement of volume, not mass. As a result, the amount of exhaust required increases with the temperature of the smoke layer.

3.1.3.3 Wind Effect

Per Section 909.4.3 of the 2009 MUBEC, the effect of wind on the smoke control system was considered but was not modeled by the FDS software, as FDS does not simulate the pressure differential on the exhaust fan equipment. The wind can have an adverse affect on the function of the exhaust system since the exhaust fan is mechanically driven and will have to overcome the pressure differential created by the wind. The wind can have an adverse affect on the make-up air supplied by open doors in the worst case wind direction condition and can impede air flow into the building. The worst case wind direction condition occurs when the wind blows against the opposite side of the building from the make-up air doors, creating negative pressure relative to the building at those doors as it flows around the building.

The mean wind speed ranges from 7.1 to 11.0 mph with a 26.7 mph 0.4% extreme wind speed (Heating and Wind Design Conditions – Portland, Maine, United States from Chapter 14 of the *2009 ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) Fundamentals Handbook)* with a general direction from the west (opposite the make-up air doors which can cause negative pressure differentials). The negative pressure differentials that are possible from these wind loads range from approximately 0.78 to 0.85 inches of water column for the mean wind speeds and can be as high as approximately 1.23 inches of water column for the extreme wind speed noted from the ASHRAE Handbook. The mechanical designer will need to provide a fan capable of supplying the required exhaust at the above negative pressure differentials relative to the building (caused by the exterior wind speeds and wind direction anticipated).

3.1.3.4 HVAC Systems

The kitchen exhaust, restroom exhaust, and HVAC systems were assumed to be off during operation of the smoke control system in order to address the effect of the HVAC systems per Section 909.4.4 of the 2009 MUBEC. There are two reasons why all exhaust systems were assumed to be off during a fire event:

1. If smoke or excessive heat is detected in a building ventilation duct system, these ducts are required to be dampered (closed off in order to terminate operation) per Section 716 of the 2009 MUBEC. It would be more conservative to assume the building ventilation system was shut down due to the presence of smoke or heat in the ventilation

ducts than to assume this would not occur.

2. It is possible that the primary source of power to the building could be lost in the event of a fire. Standby power systems are required to operate the smoke control system, not the building ventilation system. It would be more conservative to assume the building ventilation system was shut down due to loss of power than to assume this would not occur.

3.1.3.5 Climate

Per Section 909.4.5 of the 2009 MUBEC, the effect of the climate was considered along with the stack effect conditions with regards to temperature. Doors on automatic openers at the east loading docks and exterior doors will be used to provide unconditioned make-up air. There is a potential for snow or ice blockage of the make-up air and exhaust equipment in this climate that could obstruct the proper functioning of the mechanical smoke control system. It is recommended that design measures be taken to limit the effect of snow and ice blockage to the make-up air and mechanical equipment.

3.1.3.6 Duration of Operation

Per Section 909.4.6 of the 2009 MUBEC, the duration of the system operation was determined by taking the most conservative time constraint. As a result, the total required egress time value was assumed to be the 20 minute maximum required by Section 909.4.6 of the 2009 MUBEC. The 2009 Edition of NFPA 101 does not specify system duration of operation for smoke protected assembly seating.

3.1.4 Design Fundamentals

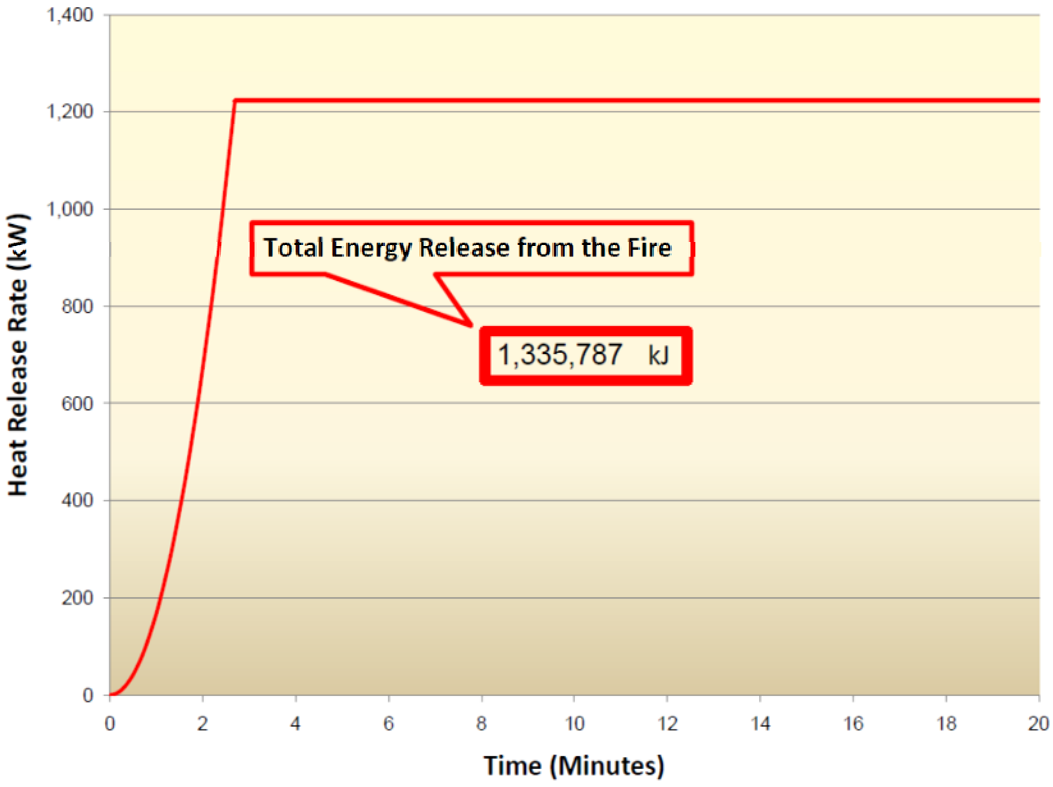
Chapters 4 and 5 of the 2005 Edition of NFPA 92B (referenced by the 2009 MUBEC) contain a list of design criteria to aid in the design of the smoke exhaust system. The following parameters were taken into consideration when designing the Cumberland County Civic Center smoke control system.

3.1.4.1 Design Fire (2005 Edition of NFPA 92B, Section 3.3.7)

The following design fire analysis addresses the design fire requirements in Section 909.9 of the 2009 MUBEC. A fast growth fire was chosen for the fire in the smoke exhaust calculations. The smoke control zone is protected by automatic sprinklers and was assumed to be a Light Hazard occupancy with potential fuel load restrictions based on this occupancy hazard classification from the 2007 Edition of NFPA 13. The design fire was assumed to grow at the fast rate until sprinkler activation, at which time the fire size was conservatively assumed to be controlled by the automatic sprinklers and remain at a steady state heat release rate until the end of the evaluation. The steady state fire is also based on the conservative assumption that a continuous fuel load is present. In many cases, fires have a limited fuel package and the effect of automatic sprinklers can actually suppress the fire. Both of these factors can

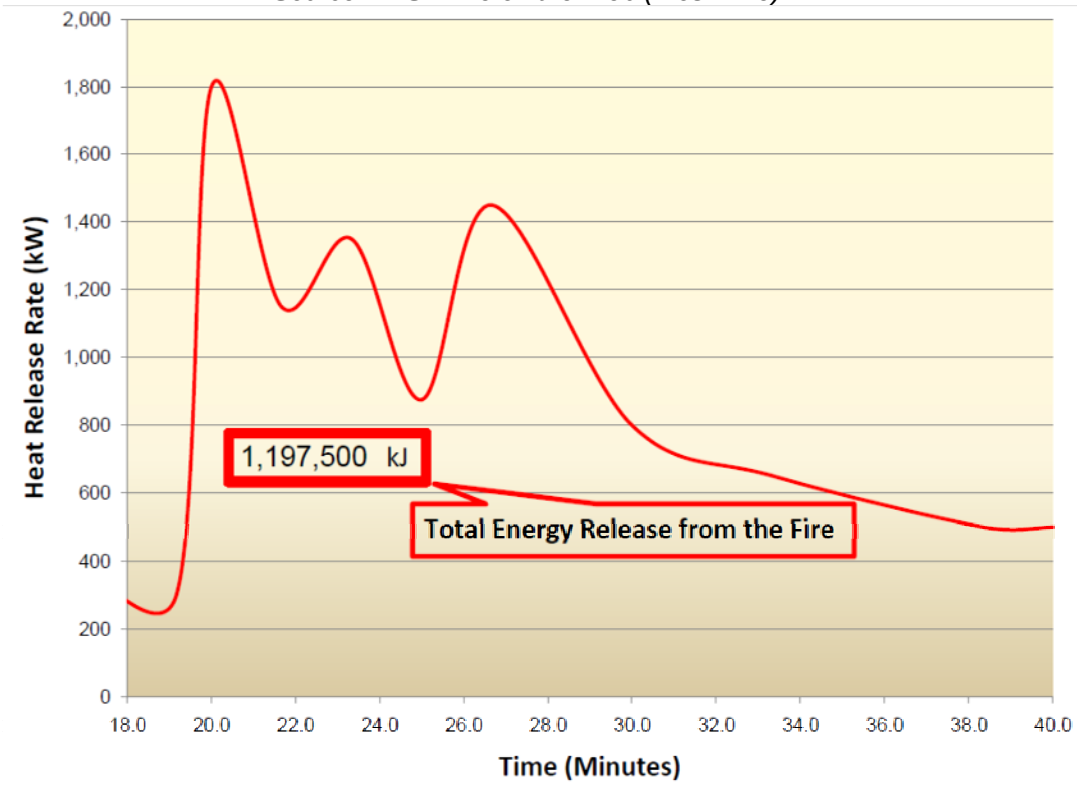
cause the fire to enter a decay phase in which reduced amounts of smoke and combustion products are produced. The simulated fires used in this evaluation do not assume that the fuel packages are consumed, that the distance between fuel packages may be so large that radiant heat is insufficient to cause ignition of adjacent fuel packages, or that the automatic sprinklers may reduce or extinguish the fire. An example of this type of fire growth model used in this analysis is shown in Figure 3.5 below.

Figure 3.5
Example of a Fast Growth, T-Squared Fire at Steady State (Design Fire 3)
Source: SFPE Handbook, 3rd Edition



1. For the design fires, it should be noted that the use of a fast growth steady state design fire is a further conservative assumption. Most fires with a limited fuel package will have an unsteady growth to a maximum heat release rate and then decay or "burn out" after the fuel package has been consumed. In most cases this unsteady growth and decay fire only reaches its maximum heat release rate for a very short period of time as shown below in Figure 3.6.

Figure 3.6
Example of an Unsteady Growth and Decay Fire
Source: NIST Fire on the Web (Kiosk Fire)



2. The unsteady growth and decay fire (Figure 3.6) transfers much less energy than a fast growth steady state heat release rate fire (Figure 3.5). By conservatively assuming a design fire that grows uniformly (fast growth T-squared) to steady state, a larger amount of energy is assumed to be released as well as a constant source of smoke, thereby providing a factor of safety versus unsteady fire growth behavior with a limited fuel package.

3. The total energy transferred by a fire can be determined from the graphs in Figure 3.5 and Figure 3.6 by determining the area under the heat release rate curve. The heat release rate is displayed in kilowatts (kW) in these graphs which is a measure of power (the energy or work done over some unit of time). A kilowatt (kW) is a kilojoule (energy) per second (unit of time). This area under the heat release rate curve will be the product of kilowatts (kilojoules per second) and time (seconds) and results in kilojoules (energy) transferred by the fire at a particular heat release rate over the time period. For the fast growth steady state fire in Figure 3.5 this is a fairly simple task – the area under the heat release rate curve is almost rectangular. For the unsteady growth and decay fire, the exercise in determining the area under the curve in Figure 3.6 is achieved using the

trapezoidal rule or some other method of estimating the integral (area under the curve).

4. In the comparison between the fires in Figure 3.5 and Figure 3.6, approximately 1.1 times the energy (1,335,787 kJ vs. 1,197,500 kJ) is transferred in the fast growth steady state fire versus the unsteady growth and decay fire.

5. NIST via its *Fire on the Web* website has provided data for numerous fire test scenarios (including the kiosk fire represented by Figure 3.6). The following images from the NIST website provide an example of what a kiosk fire would look like. The three images provide an image of the initial test condition, an image of the kiosk burning at its maximum heat release rate, and an image of the burning kiosk as the fire nears the end of its decay.

Figure 3.7
Example of an Unsteady Growth and Decay Fire
*Source: NIST Fire on the Web (*Kiosk *Fire)*
Initial Condition [0-20 minutes in Figure 3.6 above]

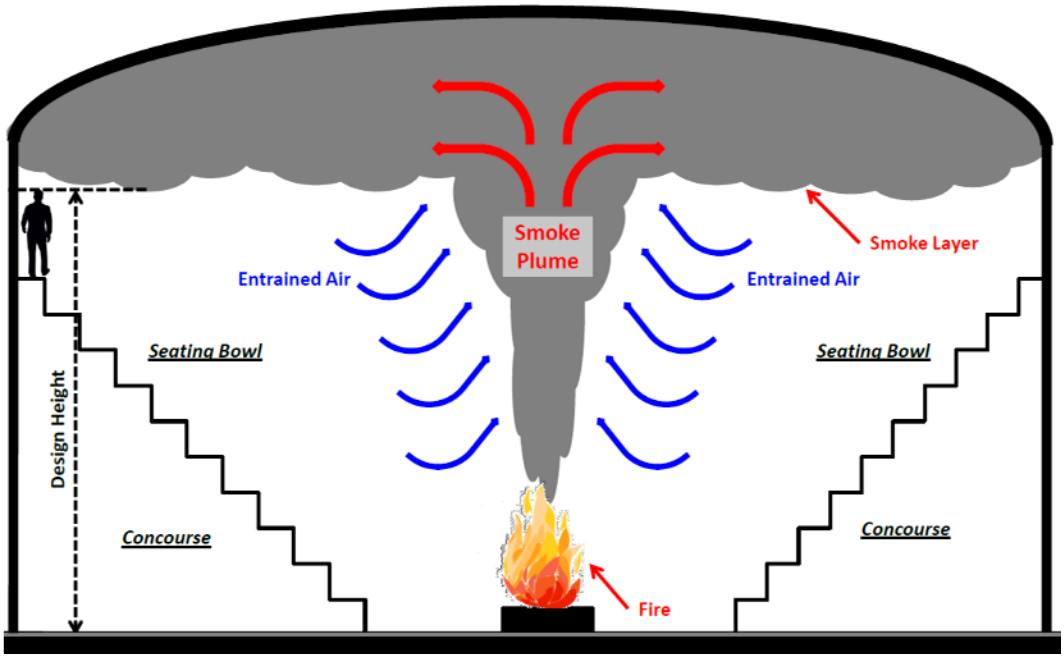
Figure 3.8
Example of an Unsteady Growth and Decay Fire
*Source: NIST Fire on the Web (*Kiosk *Fire)*
Peak Fire Growth (Maximum Heat Release Rate) [20-28 minutes in Figure 3.6 above]

Figure 3.9
Example of an Unsteady Growth and Decay Fire
*Source: NIST Fire on the Web (*Kiosk *Fire)*
Fire Decay Phase [28-40 minutes in Figure 3.6 above]

6. Five design fire scenarios were used for the Cumberland County Civic Center analysis. Two design fires were modeled on the Main Concourse in order to properly size the smoke control system for that long and narrow space.

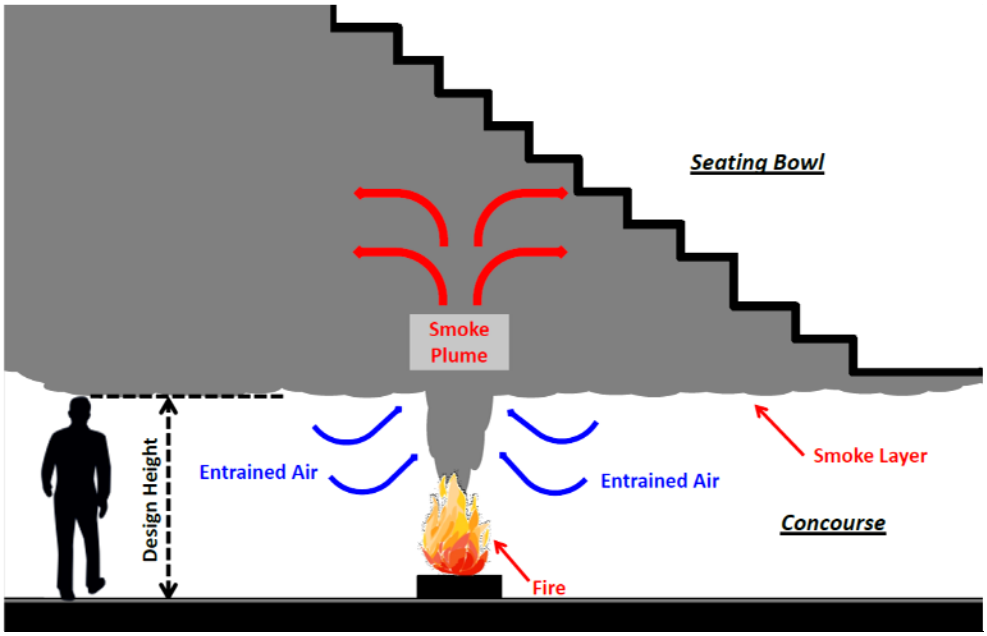
   6.1 Design Fire 1 consists of a fast growth T-squared fire located on the Event Level floor in the Seating Bowl. The expected fuel load in this space could consist of a performance stage or vehicles which can be modeled using the fast growth T-squared fire growth rateT-squared. This fire was not assumed to be sprinkler limited. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. See Figure 3.10 below for an illustration of this type of design fire.

Figure 3.10
Axisymmetric Smoke Plume Diagram



6.2 Design Fire 2 consists of a fast growth T-squared fire located on the floor of the Main Concourse near the southeast end. The expected fuel load in this space could consist of kiosks filled with merchandise which can be modeled using the fast growth T-squared fire growth rateT-squared. This fire was assumed to be sprinkler limited based on the calculations performed by the FDS software. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. See Figure 3.11 below for an illustration of this type of design fire.

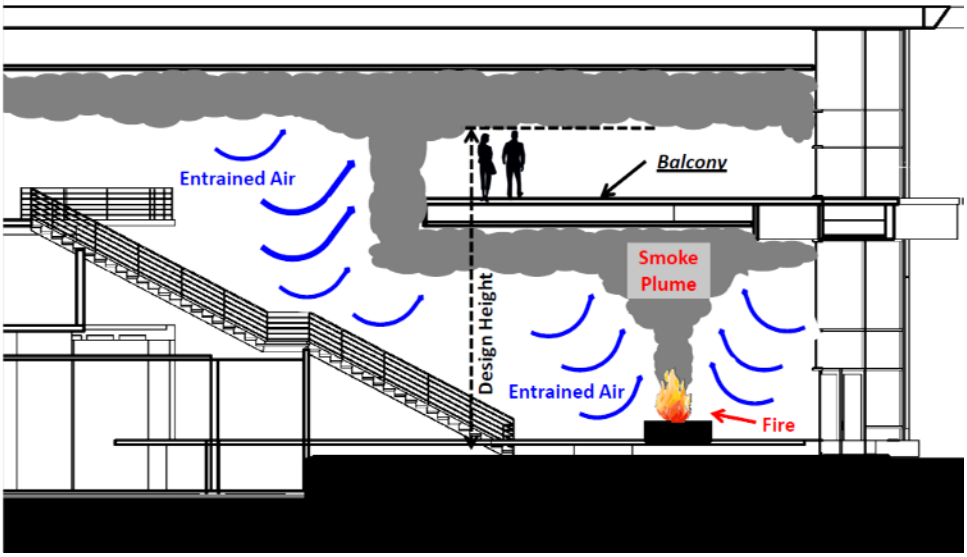
Figure 3.11
Axisymmetric Smoke Plume Diagram



6.3 Design Fire 3 consists of a fast growth T-squared fire located on the floor of the Main Concourse on the west end. The expected fuel load in this space could consist of kiosks filled with merchandise which can be modeled using the fast growth T-squared fire growth rateT-squared. This fire was assumed to be sprinkler limited based on the calculations performed by the FDS software. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume.

6.4 Design Fire 4 consists of a fast growth T-squared fire located on the Mechanical Level in the communicating space that connects to the Main Concourse by an open stair. The expected fuel load in this space could consist of kiosks filled with merchandise which can be modeled using the fast growth T-squared fire growth rateT-squared. The fire was located under the ceiling on the east side of the space away from the stair in order to create a balcony spill smoke plume. The greater amount of smoke generation possible by a balcony spill plume results because the maximum amount of air can be entrained into the smoke plume as it spills from under the ceiling of the Mechanical Level into the Main Concourse. Even though the greatest smoke volume is generated by this fire scenario, the smoke produced by it is more diluted by the large amounts of air entrained than that produced by the axisymmetric smoke plume from Design Fires 1-3. This fire was assumed to be sprinkler limited based on the calculations performed by the Fire Dynamics Simulator (FDS) software. See Figure 3.12 below for an illustration of this type of design fire.

Figure 3.12
Balcony Spill Smoke Plume Diagram



6.5 Design Fire 5 consists of a fast growth T-squared fire located on the floor of the Lobby on the west end of the Main Concourse. The expected fuel load in this space could consist of kiosks filled with merchandise or furniture which can be modeled using the fast growth T-squared fire growth rateT-squared. This fire was

assumed to be sprinkler limited based on the calculations performed by the FDS software. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. This design fire scenario creates a balcony spill plume scenario that affects the stairs that are open directly to the north of the lobby.

3.1.4.2 Height and Area (2005 Edition of NFPA 92B, Section 4.2.1)

The Cumberland County Civic Center Seating Bowl has a sloped ceiling with a maximum floor to ceiling height of approximately 60 feet. A fire directly under the highest portion of the ceiling produces the worst case smoke generation scenario as the axisymmetric smoke plume from a fire on the Event Level floor in this open area would be able to entrain the maximum amount of air as it rises to the ceiling.

The Cumberland County Civic Center Main Concourse has a sloped ceiling with a maximum floor to ceiling height of approximately 20 feet. A fire directly under the highest portion of the ceiling produces the worst case smoke generation scenario as the axisymmetric smoke plume from a fire on the Main Concourse floor in this open area would be able to entrain the maximum amount of air as it rises to the ceiling.

The balcony spill plume fire that results from a fire on the Mechanical Level (which forms a communicating space with the Main Concourse), though the 2005 Edition of NFPA 92B calculations estimate that it creates the maximum amount of smoke, will produce a smoke plume that is far more diluted than the axisymmetric plume. All scenarios were modeled using the Fire FDS for proper fan sizing and analysis of the conditions within the Arena during a fire.

The Cumberland County Civic Center West Lobby has a flat ceiling with a maximum floor to ceiling height of approximately 10 feet. A fire on the floor directly under the ceiling produces the worst case smoke generation scenario as the axisymmetric smoke plume from a fire on the Main Concourse floor in this open area would be able to entrain the maximum amount of air as it rises to the ceiling. Additionally this space creates a balcony spill plume as well that affects the stairs to the north.

3.1.4.3 Design Approach (2005 Edition of NFPA 92B, Section 4.3)

The 2005 Edition of NFPA 92B, Section 4.3 requires the design approach for a smoke management system to be a method listed in Section 4.3. The exhaust method was chosen in accordance with Section 909.8 of the 2009 MUBEC. In order to comply with the Section 909.8.1 of the 2009 MUBEC, the smoke management system has been designed so that tenable conditions are maintained six feet above the highest level of egress access in the active smoke control zone. This approach was used to maintain the smoke layer at tenable limits for a period of 20 minutes or 1.5 times the calculated egress time,

whichever is less (Section 909.4.6 of the 2009 MUBEC). The most conservative maximum duration of 20 minutes was chosen. The 2009 Edition of NFPA 101 does not specify system duration of operation for smoke protected assembly seating.

3.1.4.4 Design Considerations (2005 Edition of NFPA 92B, Section 4.2.1)

The plan area of the Cumberland County Civic Center Seating Bowl is approximately 62,561 square feet. The plan area of the Main Concourse (including Mechanical Level) is approximately 29,075 square feet. The plan area of the West Lobby is approximately 6,052 square feet. This floor area configuration was accounted for by the FDS computational fluid dynamics fire model.

3.1.4.5 Occupancies (2005 Edition of NFPA 92B, Section 4.2.1)

The area utilizing smoke control in Cumberland County Civic Center is a Assembly use group (Group A-4) occupancy.

3.1.4.6 Egress Routes (2005 Edition of NFPA 92B, Section 4.2.1)

Smoke-protected assembly seating provisions (as described in Section 1025.6.2.1 of the 2009 MUBEC and Section 12.4.2.1 (2) (a) of the 2009 Edition of NFPA 101) are utilized in the Cumberland County Civic Center. The smoke management system has been designed so that tenable conditions are maintained six feet above the highest level of egress access in the active smoke control zone.

3.1.4.7 Areas of Refuge (2005 Edition of NFPA 92B, Section 4.2.1)

The Cumberland County Civic Center does not require any areas of refuge and none have been incorporated into the design. The 2009 MUBEC and ADA (American Disabilities Act) consider a fully sprinklered building as providing an adequate level of safety without areas of refuge.

3.1.4.8 Smoke Development Analysis (2005 Edition of NFPA 92B, Section 4.3)

The smoke development analysis of the design approach chosen from the 2005 Edition of NFPA 92B, Section 4.3 is required to be justified using one of the following methods: algebraic calculations, CFD models, compartment fire models, scale modeling, or zone modeling. To satisfy this requirement, the Design Team has selected to use the FDS, CFD model provided by NIST, for the smoke development analysis.

3.1.4.9 Minimum Smoke Layer Depth (2005 Edition of NFPA 92B, Section 4.4.1.1)

The Design Team has selected a height at the minimum design depth of the smoke layer based on the requirements in the 2009 MUBEC. As part of the engineering analysis, the Design Team is designing the smoke exhaust system

to maintain the smoke layer at tenable limits at least six feet above the highest surface used for egress in the active smoke control zone (to comply with the Section 909.8.1 of the 2009 MUBEC and Section 12.4.2.1 (2) (a) of the 2009 Edition of NFPA 101).

3.1.4.10 Smoke Travel to Communicating Spaces (2005 Edition of NFPA 92B, Section 4.4.2)

1. The design of the Cumberland County Civic Center will allow smoke from one of the adjacent, non-smoke control zone adjoining spaces to spill into the large volume space of the smoke control zones (Seating Bowl, Main Concourse, or West Lobby). The Design Team has utilized the techniques allowed by the 2005 Edition of NFPA 92B, Section 4.4.2.1 and designed the exhaust system to keep the smoke six (6) feet above the highest level of egress in the active smoke control zone. The smoke generated from fires in adjoining, non-smoke control zone spaces that infiltrates into the neighboring smoke control zone was determined to be significantly less than the smoke generated by a fire in one of the smoke control zones.

2. The design of the Cumberland County Civic Center would normally allow smoke from a fire in one smoke control zone of the Arena to migrate into other smoke control zones. The purpose of the smoke control system is to maintain the smoke layer at tenable limits at least six feet above the highest surface used for egress in the active smoke control zone (to comply with the Section 909.8.1 of the 2009 MUBEC and Section 12.4.2.1 (2) (a) of the 2009 Edition of NFPA 101). The Design Team has utilized the techniques allowed by the 2005 Edition of NFPA 92B, Section 4.4.2 and designed the exhaust system to keep the smoke six feet above the highest level of egress in the active smoke control zone. The smoke generated from fires in adjoining, smoke control zone spaces that infiltrates into the neighboring smoke control zone was determined to be significantly less than the smoke generated by a fire in one of the smoke control zones.

3.1.4.11 System Startup (2005 Edition of NFPA 92B, Section 4.5.2)

The smoke management system is required to achieve full operation prior to the smoke levels reaching the design smoke conditions.

To evaluate the time it takes for the smoke exhaust system to become operational, the Design Team has considered the following design factors from the 2005 Edition of NFPA 92B, Section 4.5.2.2.

1. Time for detection of a fire incident in the Cumberland County Civic Center can be estimated from the time for sprinkler activation or smoke detector activation. The beam detectors were essential for proper system operation for a fire in the open on the Event Level floor in the Seating Bowl (axisymmetric Design Fire Scenario 1) as a

sprinkler-limited fire was not assumed. The area detectors were essential for proper system operation for a fire on the Mechanical Level Lobby (balcony spill plume Design Scenario Fire 4) and in the West Lobby (axisymmetric Design Fire Scenario 5). Automatic sprinklers were the primary method of system activation for Design Fire Scenario 2 and Design Fire Scenario 3 in the Main Concourse. This time to activation can be estimated using the FDS software. Detailed information on the detection parameters is provided in Section 3.2 of this report.

Table 3.1
Fire Scenario Estimated Sprinkler Activation Times

Fire Scenario	Ceiling Height (Feet)	Estimated Activation Time (Seconds)
1 – Seating Bowl Axisymmetric Plume	60.7	514.4
2 – South Main Concourse Axisymmetric Plume	26.5	133.3
3 – West Main Concourse Axisymmetric Plume	26.5	154.7
4 – Lower Level Balcony Spill Plume	34.5	157.6
5 – West Lobby Axisymmetric Plume	10	130.6

Table 3.2
Fire Scenario Estimated Smoke Detector Activation Times

Fire Scenario	Ceiling Height (Feet)	Estimated Activation Time (Seconds)
1 – Seating Bowl Axisymmetric Plume	60.7	51.2
2 – South Main Concourse Axisymmetric Plume	26.5	***No Smoke Detectors Used***
3 – West Main Concourse Axisymmetric Plume	26.5	***No Smoke Detectors Used***
4 – Lower Level Balcony Spill Plume	34.5	38.4
5 – West Lobby Axisymmetric Plume	10	37.4

2. Response times for the smoke control system activated by automatic sprinkler waterflow switch or automatic smoke detectors were assumed to be the following (and are assumed to run simultaneously):

   2.1 For the make-up air, a total of 90 seconds from the time of detection (automatic sprinkler or beam smoke detector activation) until the systems providing make-up air were actuated. This accounts for the transmission time between the

water flow switch (or smoke detector) and the alarm panel (60 seconds) and then transmission time to the make-up air systems (10 seconds).

2.1.1 The Cumberland County Civic Center will be provided with make-up air via overhead doors on automatic openers on the east loading dock and exterior doors (see illustrations IL.002 through IL.003 shown previously in the report).

2.2 For the mechanical exhaust, a total of 90 seconds from the time of detection (automatic sprinkler activation or smoke detector activation) until the smoke control exhaust fans are operational. This accounts for the transmission time between the water flow switch (or smoke detector) and the alarm panel (60 seconds), transmission time to the fans (10 seconds), and exhaust fan ramp-up time (20 seconds).

3. For manual activation, a total of 60 seconds was assumed for the activation of the make-up air and mechanical smoke exhaust systems from the time of manual activation from the Firefighter's smoke control panel per Section 909.17 of the 2009 MUBEC.

3.1.4.12 Make-Up Air (2005 Edition of NFPA 92B, Section 4.6)

Make-up air for the smoke control system will be supplied through natural ventilation provided by overhead doors in the loading dock on the east end of the building and exterior doors that were modeled to open automatically upon system actuation. Make-up air will travel from the loading dock through the Seating Bowl and into other areas of the building and into the building from the exterior doors on the southeast and southwest. The illustrations outlined in Table 1.2 below represent the make-up air supply plan.

According to the NFPA Handbook (20th Edition, Volume 2, pages 18-54), CFD models like the FDS can realistically simulate air (and smoke) flow up to Mach 0.3 (20,000 feet per minute). The FDS software can simulate plugholing (as normally calculated with NFPA 92B algebraic equations) and model the affects of air flows over 200 feet per minute into the smoke control zone towards the design fire with the subsequent effect on the quantity of smoke produced (the limiting assumption of the NFPA 92B algebraic equations).

3.1.4.13 Operating Conditions (2005 Edition of NFPA 92B)

The smoke management system components are required (2005 Edition of NFPA 92B, Section 4.7) to be capable of continuous use at the maximum temperature expected over the design interval time.

The FDS simulations were used to estimate the temperature at the exhaust vents in the Cumberland County Civic Center smoke control zone for the Design Fire scenarios. The Cumberland County Civic Center is provided with automatic

sprinklers as part of the FDS simulations. Temperatures at the exhaust vents were calculated using thermocouple slice files.

Table 3.3

Fire Scenario Maximum Exhaust Equipment Temperatures

FIRE SCENARIO	MAXIMUM EXHAUST VENT TEMPERATURE
1 – Seating Bowl Axisymmetric Plume	110° F [1]
2 – South Main Concourse Axisymmetric Plume	80° F [1]
3 – West Main Concourse Axisymmetric Plume	95° F [1]
4 – Lower Level Balcony Spill Plume	123° F [2]
5 – West Lobby Axisymmetric Plume	98° F [1]

[1] These temperatures are estimated based on slice file measurements recorded in the FDS software at the exhaust vents and not on the temperatures at the sprinklers (165°F). The lower temperatures result from the ceiling jet of the smoke plume traveling across the ceiling to the exhaust vents and cooling from the presence of automatic sprinklers.

[2] These temperatures were estimated using the same methods noted in Footnote 1 above. The lower temperatures that result are from the balcony spill plume from the Mechanical Level lobby that entrains more air and has more time to cool as the smoke plume travels to the ceiling to the exhaust vents.

3.2 SMOKE EXHAUST MODELING

For the Design Fire Scenarios a CFD model was determined to be the best approach to model the conditions in the Cumberland County Civic Center due to the complex floor geometry relationships in the Arena. Tenability criteria, which are based upon temperature, visibility (optical density of the smoke), and gas concentrations, are examined as the benchmark of acceptability for the results of the computational fluid dynamics fire model in accordance with the guidance in Section A.3.3.8 of the 2005 Edition of NFPA 92B.

The smoke exhaust system and the automatic sprinkler system in the Cumberland County Civic Center smoke control zones were modeled using the FDS, a program developed by NIST. The FDS software can calculate the evolving distribution of smoke, fire gases, and temperature during a fire by solving numerically a form of the Navier-Stokes equations appropriate for low-speed, thermally-driven flow with an emphasis on smoke and heat transport from fires. The FDS package includes NIST's Smokeview program, which visualizes with colored, three-dimensional animations, the results of the FDS simulation of a specific fire's temperatures, various gas concentrations, and growth and movement of smoke layers across multi-room structures. A further discussion of the FDS software is provided in **Appendix A** of this report.

3.2.1 FDS Model Scenarios and Assumptions

The following scenarios were used to model the conditions within the Arena.

Table 3.4

Cumberland County Civic Center Smoke Control Zone FDS Fire Simulation Scenarios

FIRE SCENARIO	DESCRIPTION
Design Fire 1	Non-Sprinkler Limited Fast Growth T-Squared Fire 10,000 kilowatts (kW) [9,487 Btu/sec] Axisymmetric Plume
Design Fire 2	Sprinkler Limited Fast Growth T-Squared Kiosk Fire 834 kilowatts (kW) [791 Btu/sec] Axisymmetric Plume
Design Fire 3	Sprinkler Limited Fast Growth T-Squared Kiosk Fire 1,122 kilowatts (kW) [1,065 Btu/sec] Axisymmetric Plume
Design Fire 4	Sprinkler Limited Fast Growth T-Squared Kiosk Fire 1,165 kilowatts (kW) [1,105 Btu /sec] Balcony Spill Plume
Design Fire 5	Sprinkler Limited Fast Growth T-Squared Sofa/Kiosk Fire 793 kilowatts (kW) [752 Btu/sec] Axisymmetric Plume

The starting temperature for the interior space of the Cumberland County Civic Center in the design fire scenario was assumed to be 70°F as it was assumed that this is a conditioned space.

The assumptions listed in Table 3.5 were used to construct the FDS model for smoke exhaust analysis.

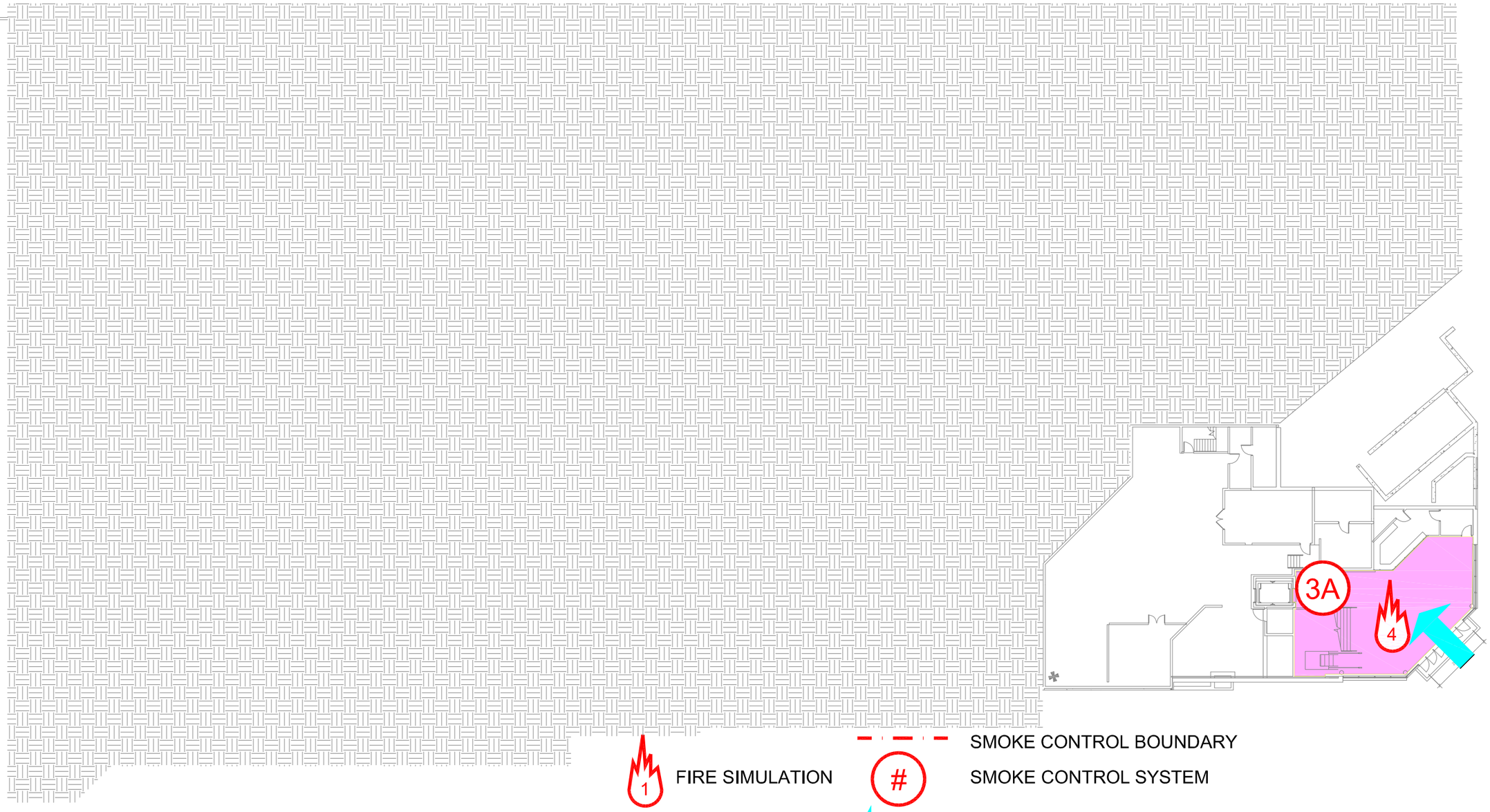
Table 3.5

Cumberland County Civic Center Smoke Control Zone FDS Model Assumptions

PARAMETER	PARAMETER VALUE	NOTES
Simulation Time	1,200 seconds (20 minutes)	Per 2009 MUBEC Section 909.4.6
Internal Temperature	70°F	Normal Temperature and Pressure
External Temperature Wind Speed/Direction	86.8°F Not modeled (See 3.1.3.3)	Section 3.1.3 of this report: *2009 ASHRAE Fundamentals*, Chapter 14 for Portland, ME
Ceiling Material	Steel / Gypsum Board	Existing Construction
Exterior Wall Material	Concrete, Normal Weight	Existing Construction
Interior Wall Material	Concrete, Normal Weight	Existing Construction
Floor Material	Concrete, Normal Weight	Existing Construction
Initial Fire Characteristics • Design Fire 1 • Design Fires 2-5	Max HRRPUA[1] / Growth Rate • 75 BTU/s-ft^2 / Fast, T-Squared • 75 BTU/s-ft^2 / Fast, T-Squared	Per Section 3.1.4.1 of this report: • The fire size was based on a 9,487 BTU/s [10 MW] vehicle fire • The fire size was based on a 4,743 BTU/s [5 MW] kiosk fire
Revised Fire Characteristics: • Design Fire 1 • Design Fire 2 • Design Fire 3 • Design Fire 4 • Design Fire 5	Max HRR / Growth Rate • 9,487 BTU/second / Fast Fire • 791 BTU/second / Fast Fire • 1,065 BTU/second / Fast Fire • 1,105 BTU/second / Fast Fire • 752 BTU/second / Fast Fire	Sprinkler activation time • 514.4 seconds • 133.3 seconds • 154.7 seconds • 157.6 seconds • 130.6 seconds
Smoke Detector Activation: • Design Fire 1 • Design Fire 4 • Design Fire 5	• Activation Time: 51.2 sec • Activation Time: 38.4 sec • Activation Time: 37.4 sec	• Beam Smoke Detectors • Area Smoke Detectors • Area Smoke Detectors
Sprinkler Flow Rate	0.1 Gallons/minute/square foot 225 square feet x 0.1 gpm/square foot= 22.5 gpm 22.5 gpm = 85.17 liters/minute	2007 Edition of NFPA 13, Figure 11.2.3.1.1 Area based on sprinkler spacing (15 feet x 15 feet)
Automatic Sprinkler	RTI: 50 ft ½•s ½ Activation Temperature: 165°F Spacing: 15 feet x 15 feet	NFPA Handbook, 19th Ed. p 10-253 2007 Edition of NFPA 13, Table 6.2.5.1 2007 Edition of NFPA 13, Table 8.8.2.1.2
Smoke Detector	Obscuration: 1.66%/foot Beam Detector Spacing: 30 feet Obscuration: 4 % Smoke Detector Spacing: 30 feet	Typical max obscuration (50%) 2007 Edition of NFPA 72, Section 11.5.1.3.1 UL 268, Gray Smoke 2007 Edition of NFPA 72, Section 11.5.1.3.1

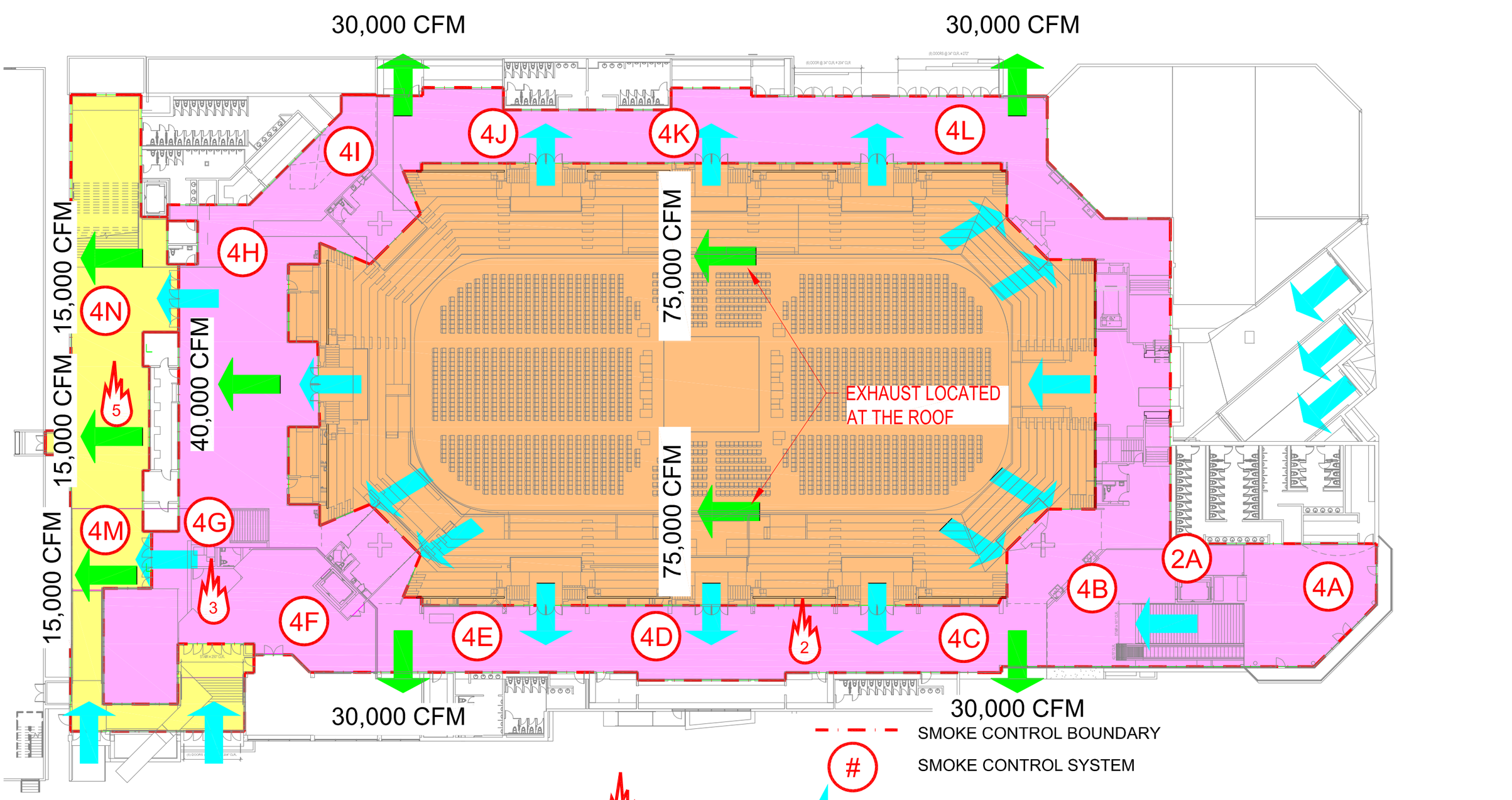
[1] *The heat release rate per unit area (HRRPUA) determines the floor area or footprint of the design fire. A HRRPUA of 75 BTU/s-ft^2 is used for all design fires. This value is more conservative than the 50 BTU/s-ft^2 recommended by Section A5.2.1 of the 2005Edition of NFPA 92B for mercantile spaces as it results in a larger fire for the same fire area.*

Illustrations SI.001 through SI.004 on the following pages detail the Design Fire Scenarios modeled in the Arena using the FDS.



SOUTH EAST LOBBY

FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

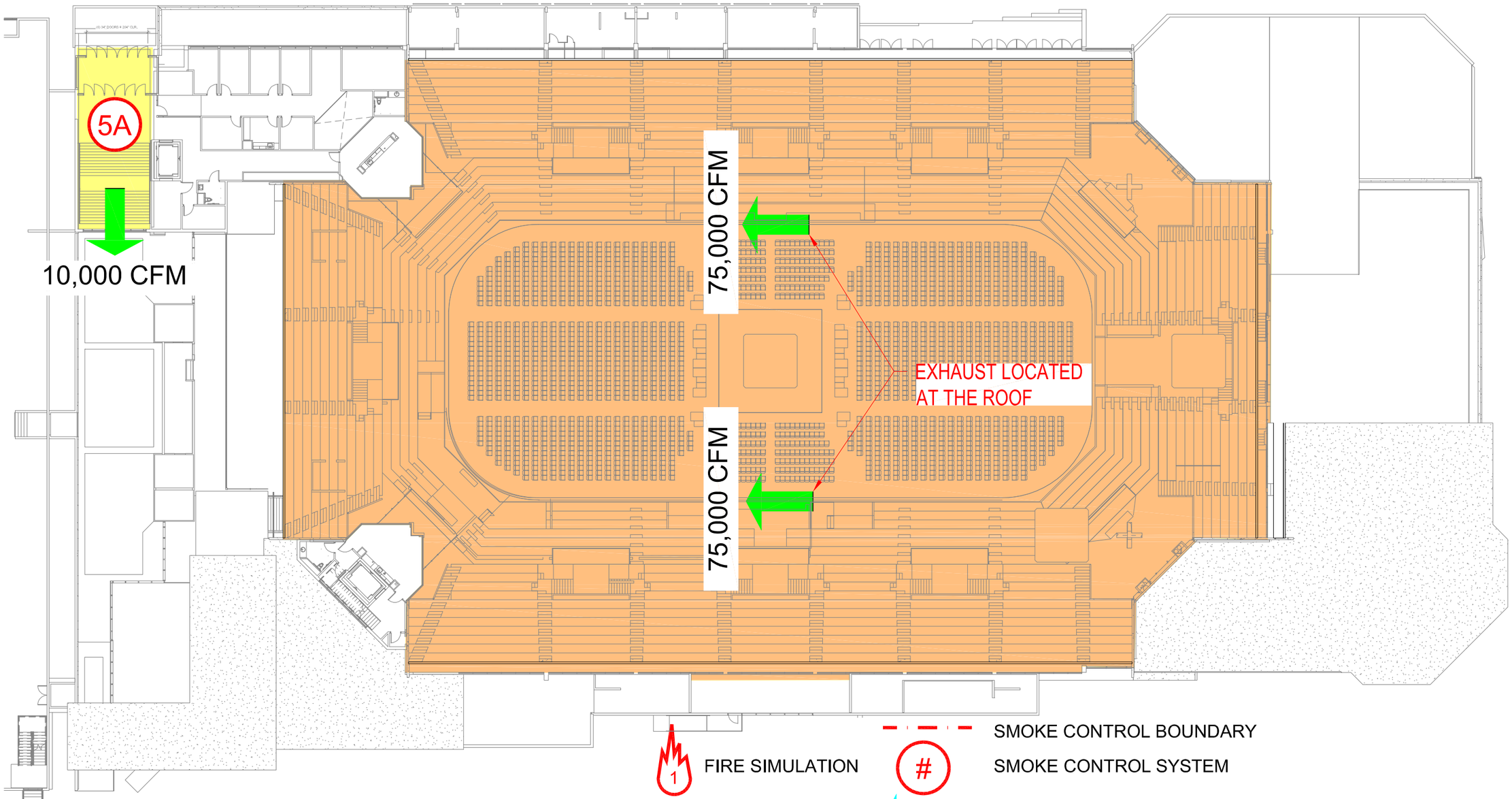


FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

CONCOURSE LEVEL

SI.002

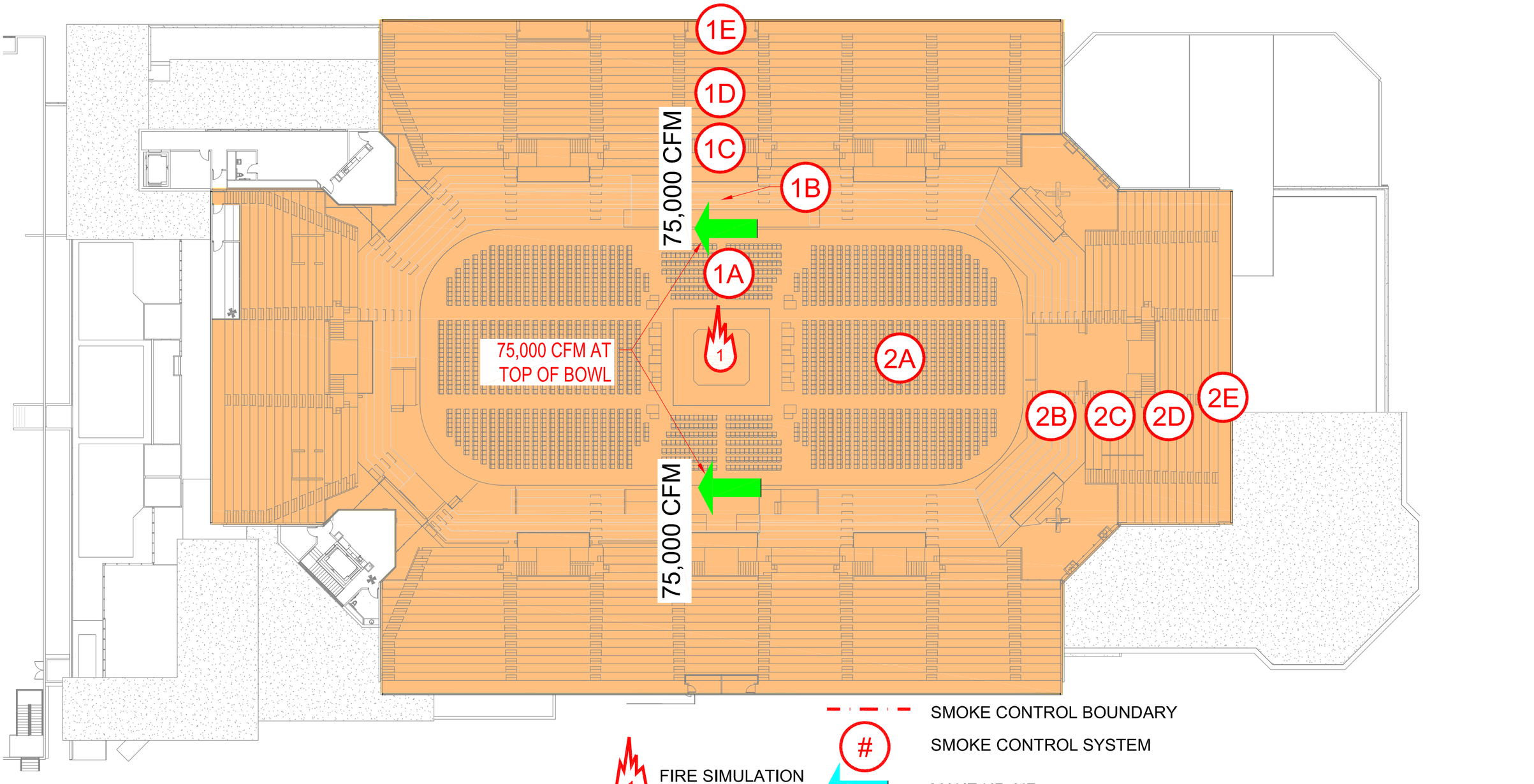
PLOT: RICHARD BRUCE October 12, 2012 11:19 AM 3'-0 67/256" = 1'-0" COLOR1700.CTB (LAYOUT: SI.002)
RICHARDB Friday, October 12, 2012 P:\ACTIVE PROJECTS\7657\00 CUMBERLAND COUNTY CIVIC CENTER RENOVATION\CAD\CURRENT\SI\SI.002.DWG



FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

MID SUITES LEVEL

SI.003



UPPER SUITE LEVEL

FP&C CONSULTANTS, INC. FIRE PROTECTION & CODE CONSULTANTS

SI.004

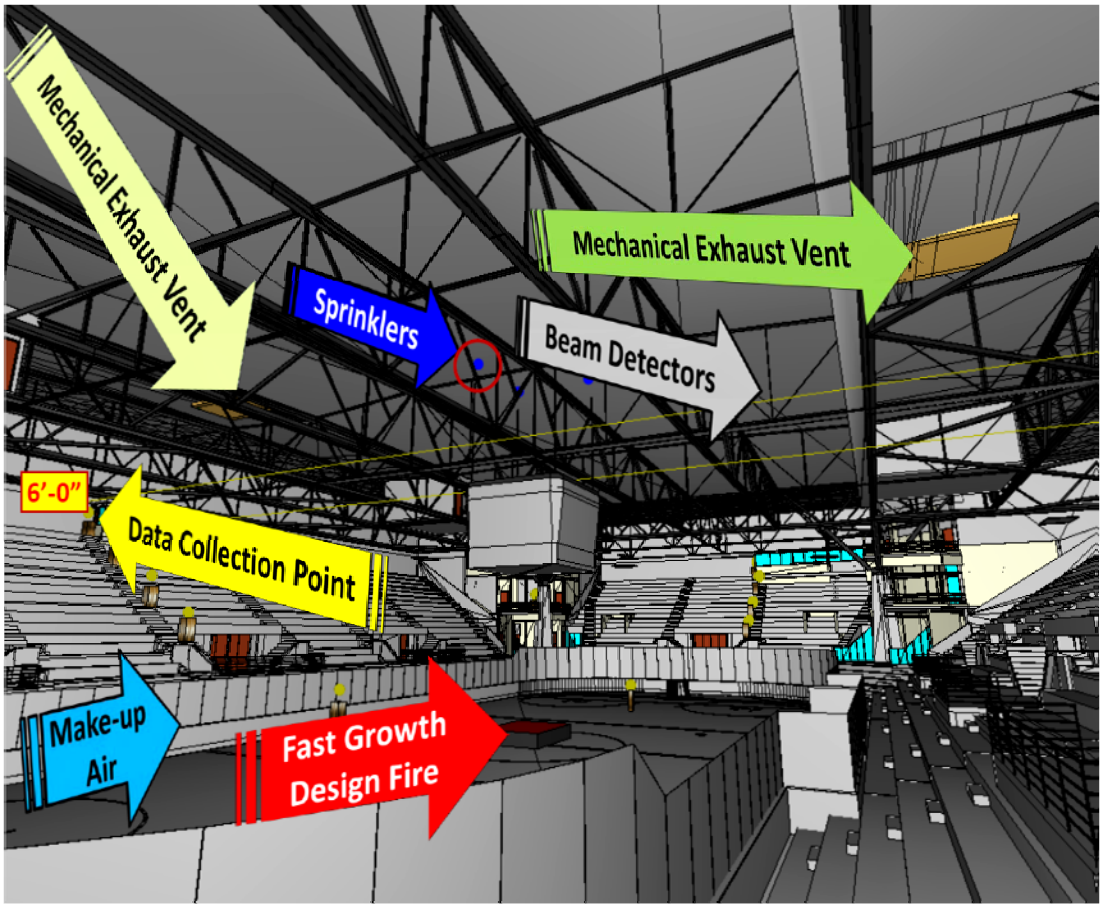
3.3 FDS MODEL RESULTS

The images and graphs on the following pages present the results of the smoke exhaust system for the following fire scenarios:

3.3.1 Design Fire Scenario 1

Design Fire 1 consists of a fast growth T-squared fire located on the Event Level floor in the Seating Bowl. The expected fuel load in this space could consist of a performance stage or vehicles which typically burn slower than the fast growth T-squared rate based on test data. This fire was not assumed to be sprinkler limited. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. The axisymmetric smoke plume provides the most concentrated smoke and was therefore the worst case scenario for sizing the exhaust fans in the Seating Bowl of the Arena. This scenario also modeled the worst-case external conditions of reverse stack effect conditions (summer high temperature) per Section 3.1.4.1 of this Report.

Figure 3.13
Illustration Depicting Lower Level of the Cumberland County Civic Center for Design Fire 1



Note the following from the image above:

1. The location of the design fire.

2. The mechanical exhaust vent locations (75,000 cfm each vent with two vents located in the roof). Temperature data was recorded at these vents.

3 The location of the tenability data collection points. These data collectors took measurements at six feet above the floor for temperature, visibility, and carbon monoxide concentration. See the SI.001 through SI.004 illustrations on the previous pages for additional information.

4. The locations of the beam smoke detectors and automatic sprinklers are depicted. The depicted locations of these devices were meant to be representative locations used for fire and smoke modeling purposes and do not represent required locations.

5. The location of the make-up air provided by the east Event Level vomitory that connects to the loading docks on the east end of the building.

Figure 3.14
Design Fire 1
Heat Release Rate

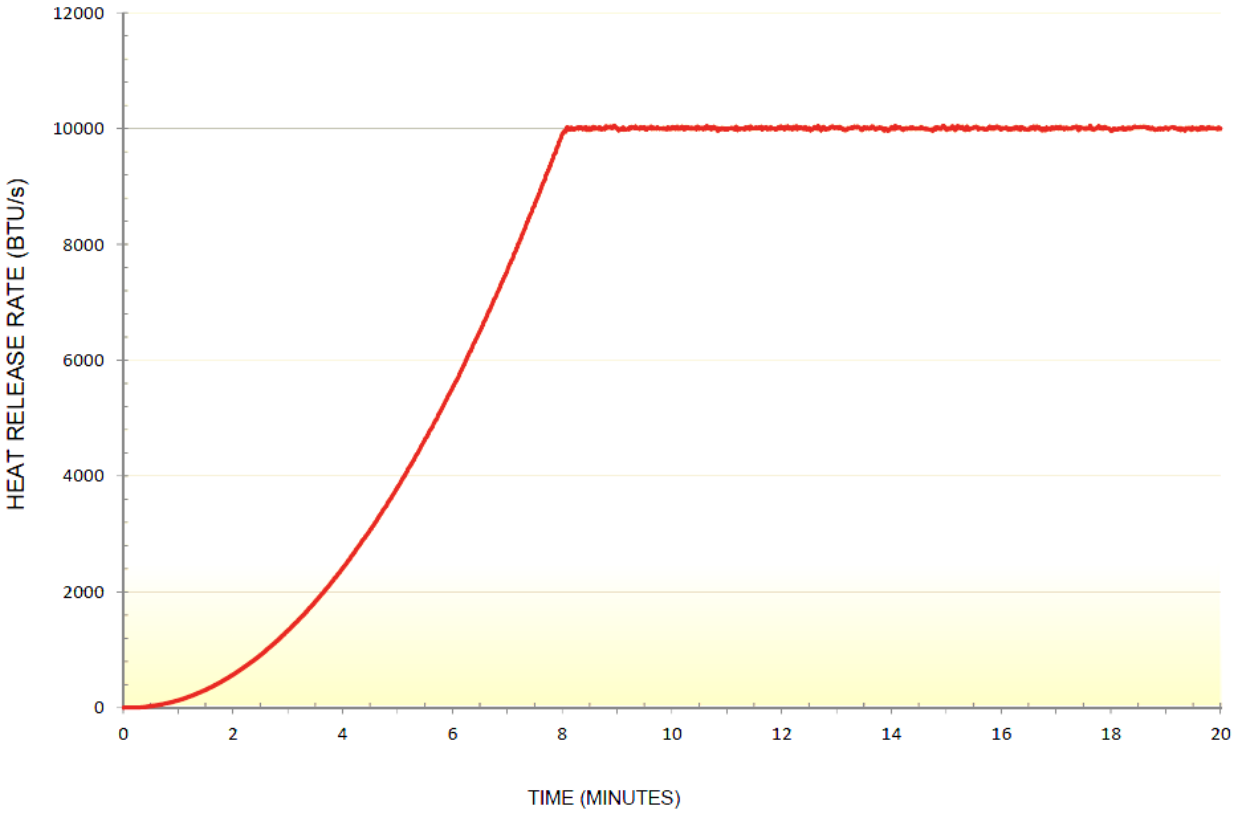
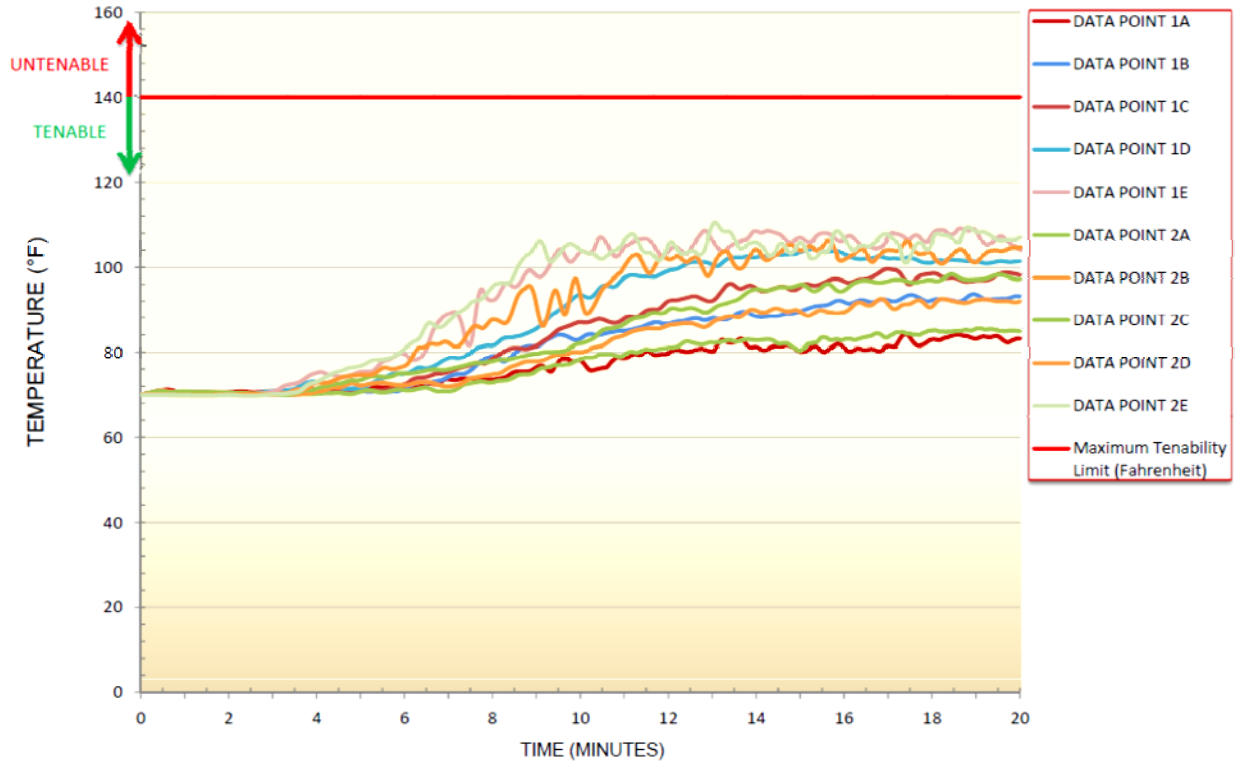
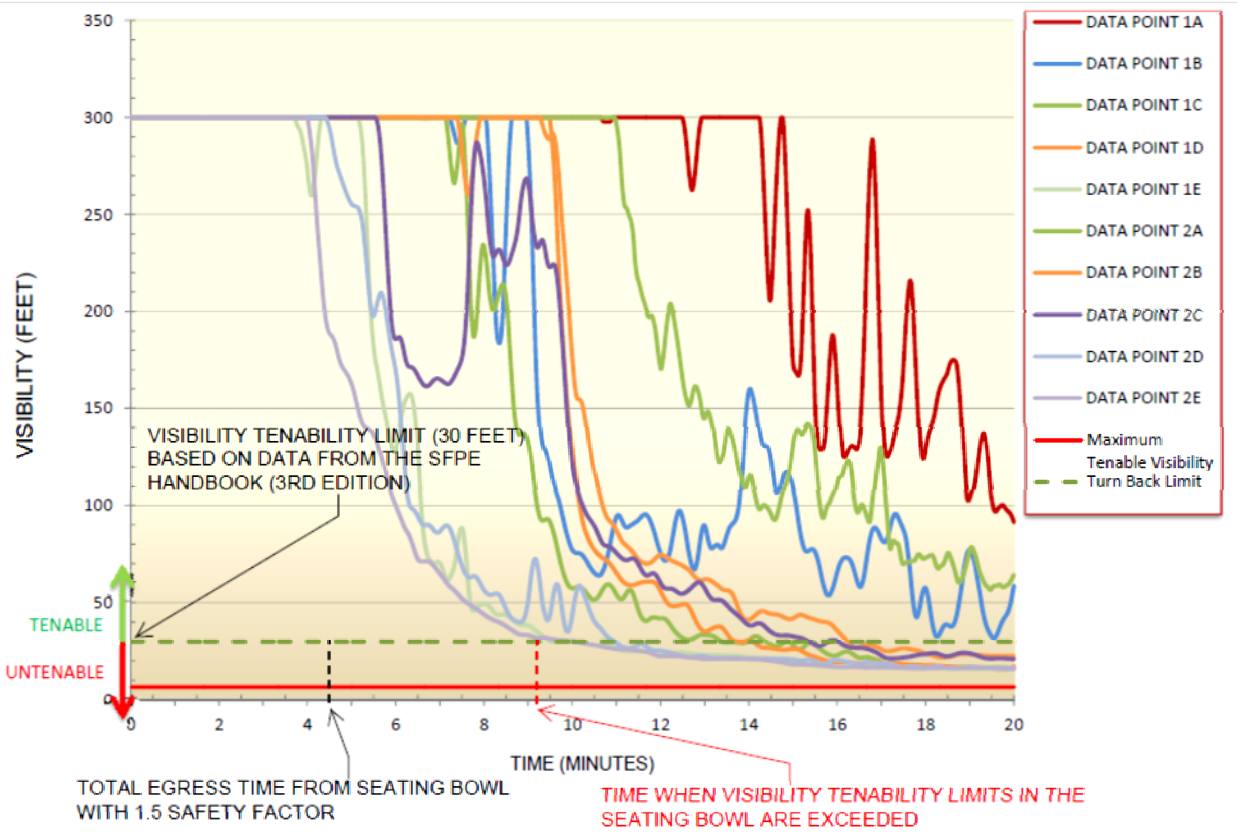


Figure 3.15
Design Fire 1
Temperature Measurements at Tenability Data Collection Points
(Six Feet Elevation)



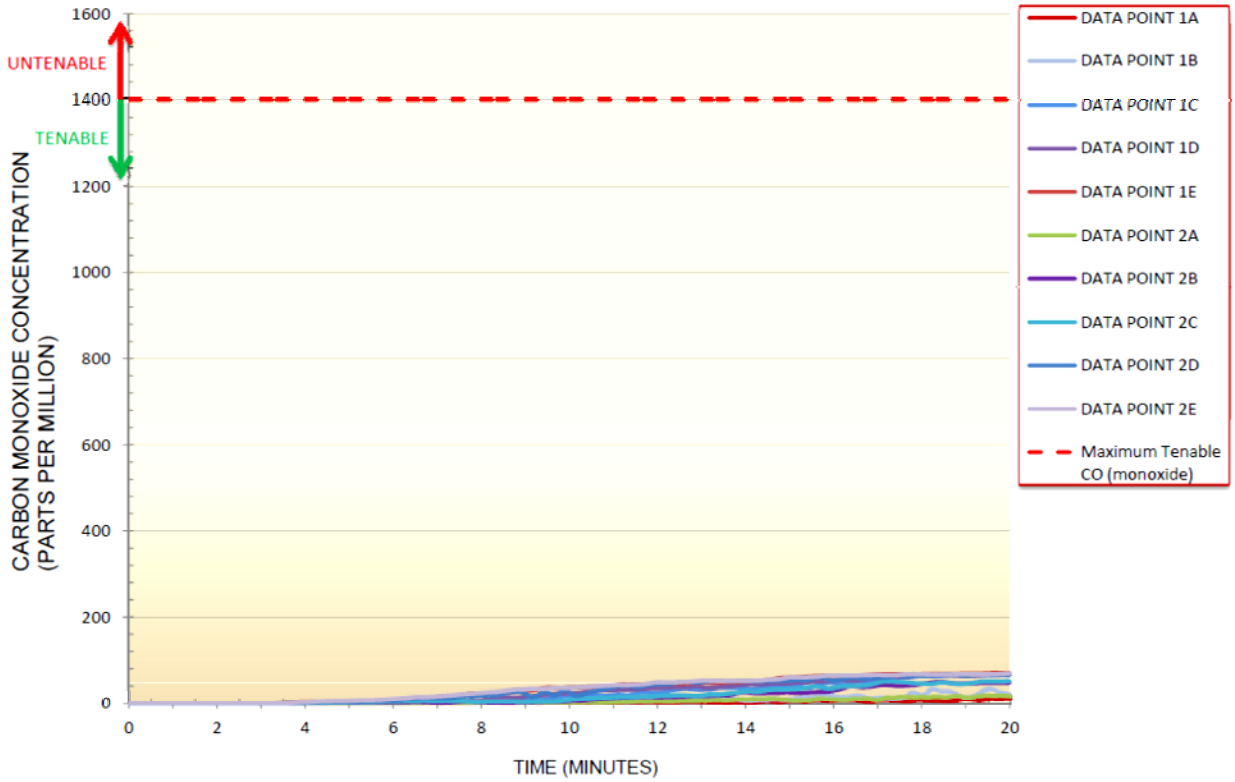
Temperature levels are maintained within tenable limits during the simulation.

Figure 3.16
Design Fire 1
Visibility Measurements at Tenability Data Collection Points 1E and 2E
(Six Feet Elevation)



Visibility levels are maintained within tenable limits during the simulation for the duration of the required egress time (with a 1.5 safety factor). Since the total egress time multiplied by the 1.5 safety factor (4.5 minutes) is less than the time it takes for the visibility at data points 1E and 2E (six feet above the highest seats in the Seating Bowl) to drop below 30 feet (9.1 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six feet above the highest seats in the Seating Bowl in accordance with Section 909.8 of the 2009 MUBEC. Please see **Appendix B** for a further explanation of these calculations.

Figure 3.17
Design Fire 1
Carbon Monoxide Concentration Measurements at Tenability Data Collection Points
(Six Feet Elevation)

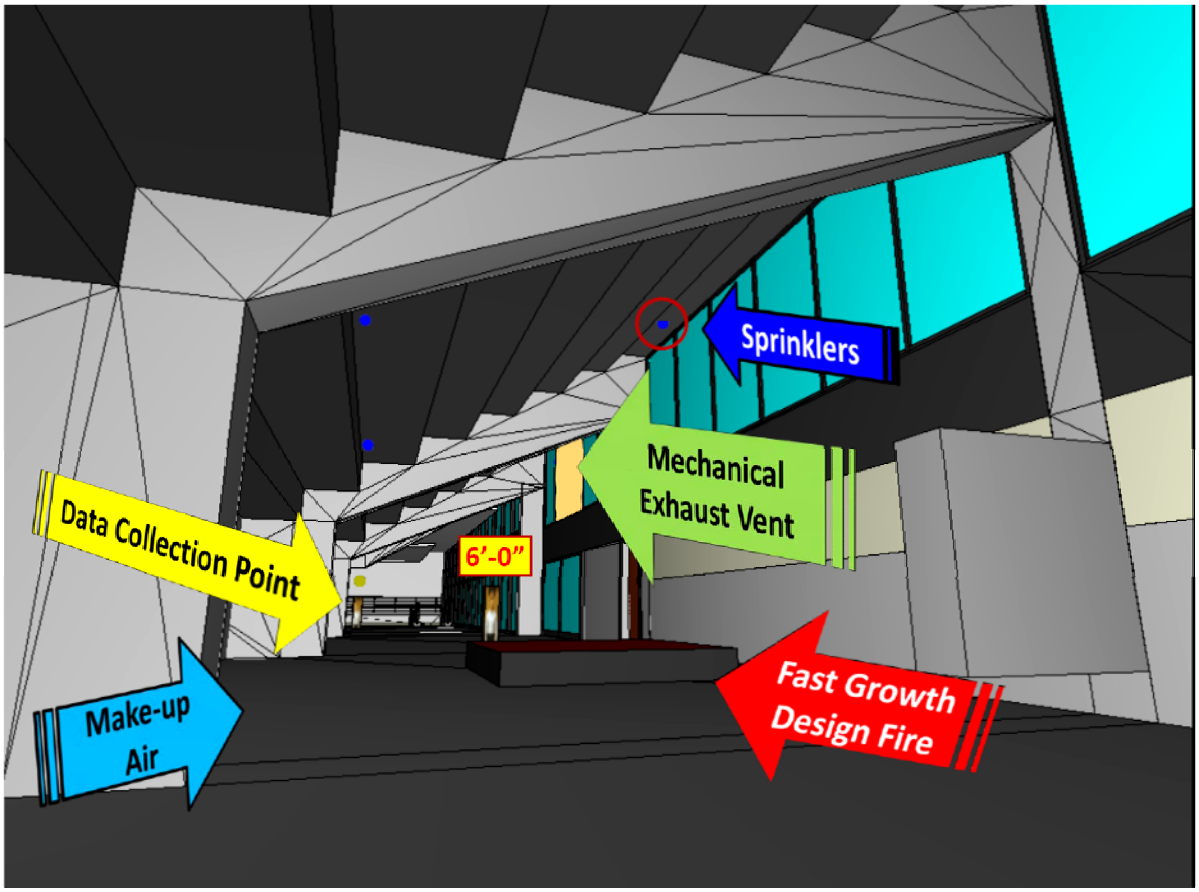


Carbon monoxide levels are maintained within tenable limits floors during the simulation.

3.3.2 Design Fire Scenario 2

Design Fire 2 consists of a fast growth T-squared fire located on the floor of the Main Concourse near the southeast end. The expected fuel load in this space could consist of kiosks filled with merchandise which typically burn slower than the fast growth T-squared rate based on test data. This fire was assumed to be sprinkler limited based on the calculations performed by the FDS software. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. The axisymmetric smoke plume provides the most concentrated smoke and was therefore the worst case scenario for sizing the exhaust fans on the Main Concourse of the Arena. The smoke control system in the Main Concourse was designed to primarily activate by automatic sprinkler activation. This scenario also modeled the worst-case external conditions of reverse stack effect conditions (summer high temperature) per Section 3.1.4.1 of this Report.

Figure 3.18
Illustration Depicting Lower Level of the Cumberland County Civic Center for Design Fire 2



Note the following from the image above:

1. The location of the design fire.

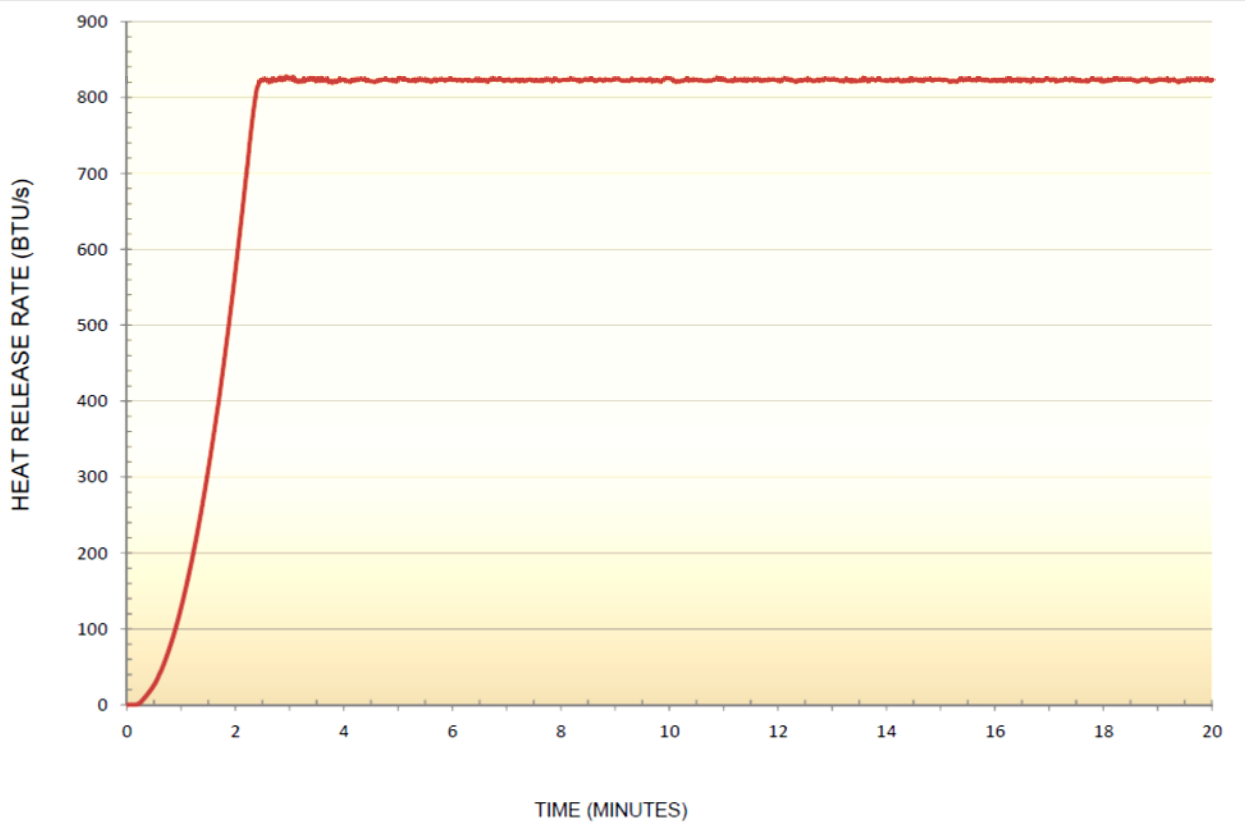
2. The mechanical exhaust vent locations (30,000 cfm each vent with two vents located in the wall of the Main Concourse). Temperature data was recorded at these vents.

3 The location of the tenability data collection points. These data collectors took measurements at six feet above the floor for temperature, visibility, and carbon monoxide concentration. See the SI.001 through SI.004 illustrations on the previous pages for additional information.

4. The locations of the automatic sprinklers are depicted. The depicted locations of these devices were meant to be representative locations used for fire and smoke modeling purposes and do not represent required locations.

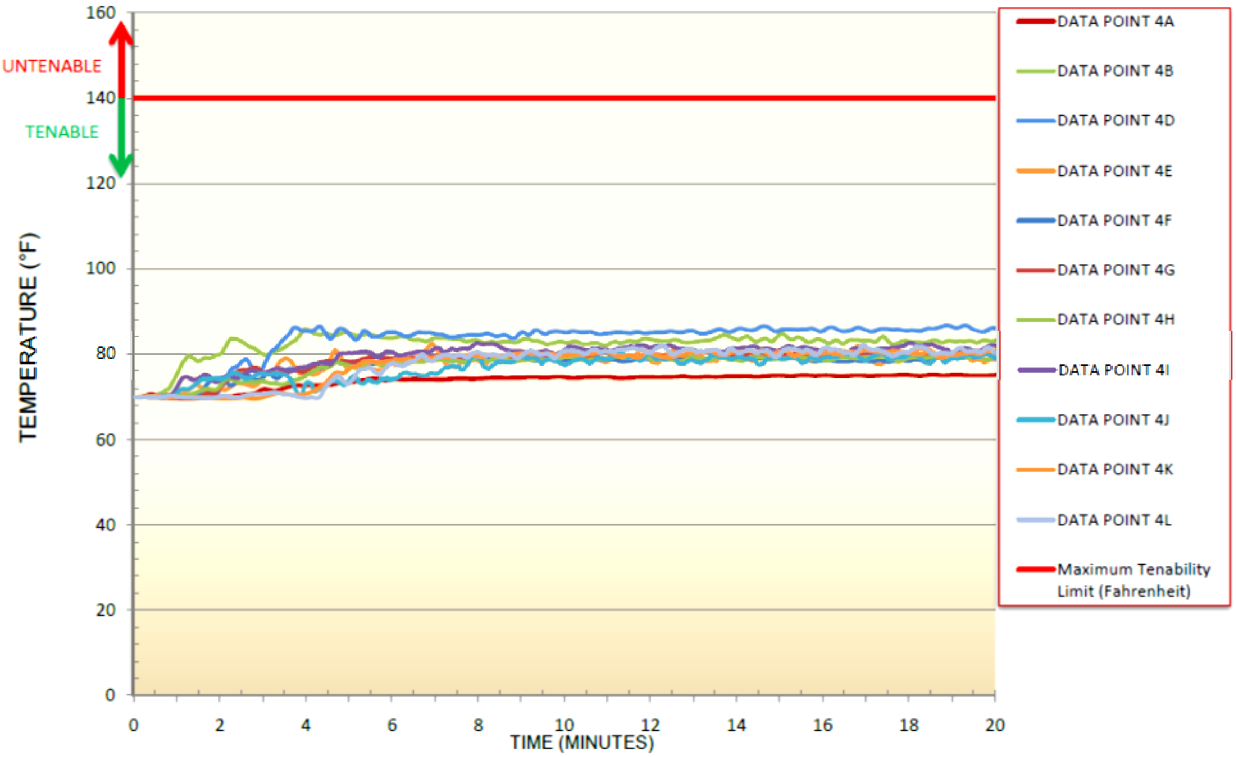
5. The location of the make-up air provided by the vomitories to the Seating Bowl (supplied from loading docks on the east end of the building).

Figure 3.19
Design Fire 2
Heat Release Rate



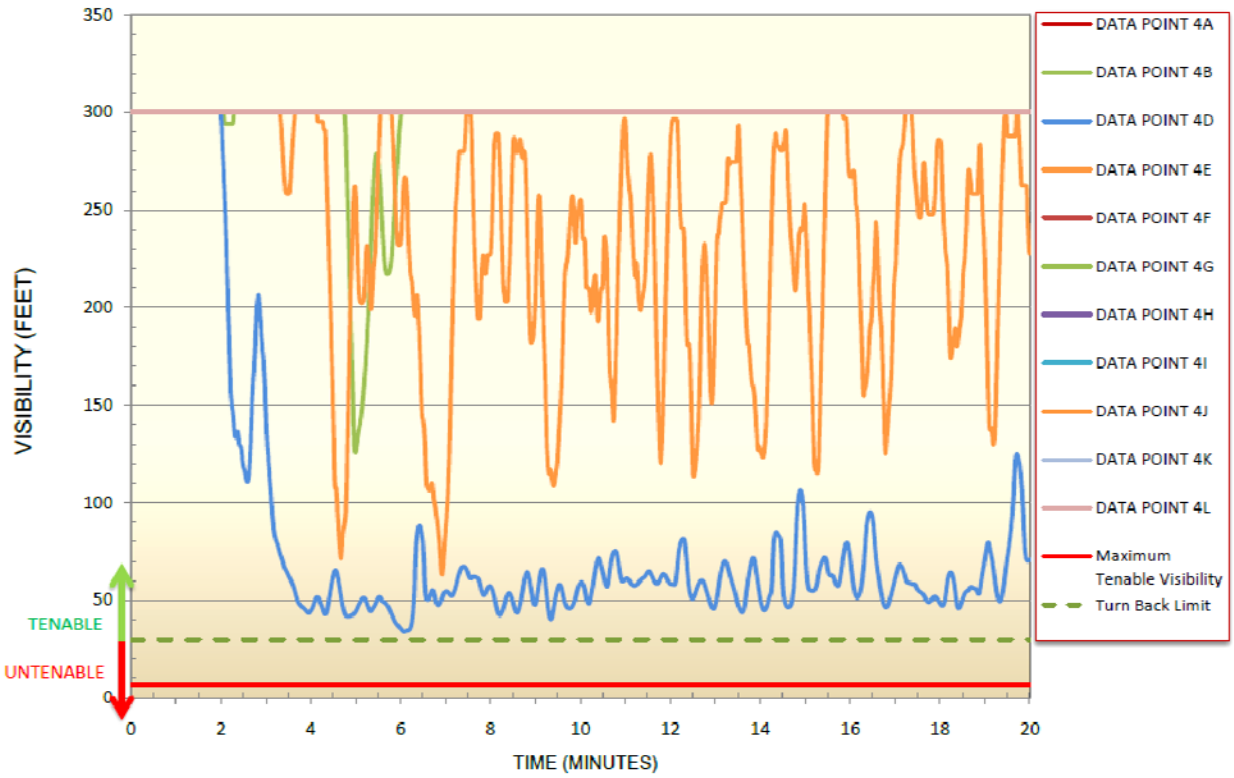
Note that the sprinkler activation temperature (165°F) is reached at approximately two minutes (133 seconds) and corresponds to the point at which the design fire is controlled at a steady state heat release rate (HRR). This activation time of 133 seconds was used with the fast growth T-squared (time in seconds) fire growth model.

Figure 3.20
Design Fire 2
Temperature Measurements at Tenability Data Collection Points
(Six (6) Feet Elevation)



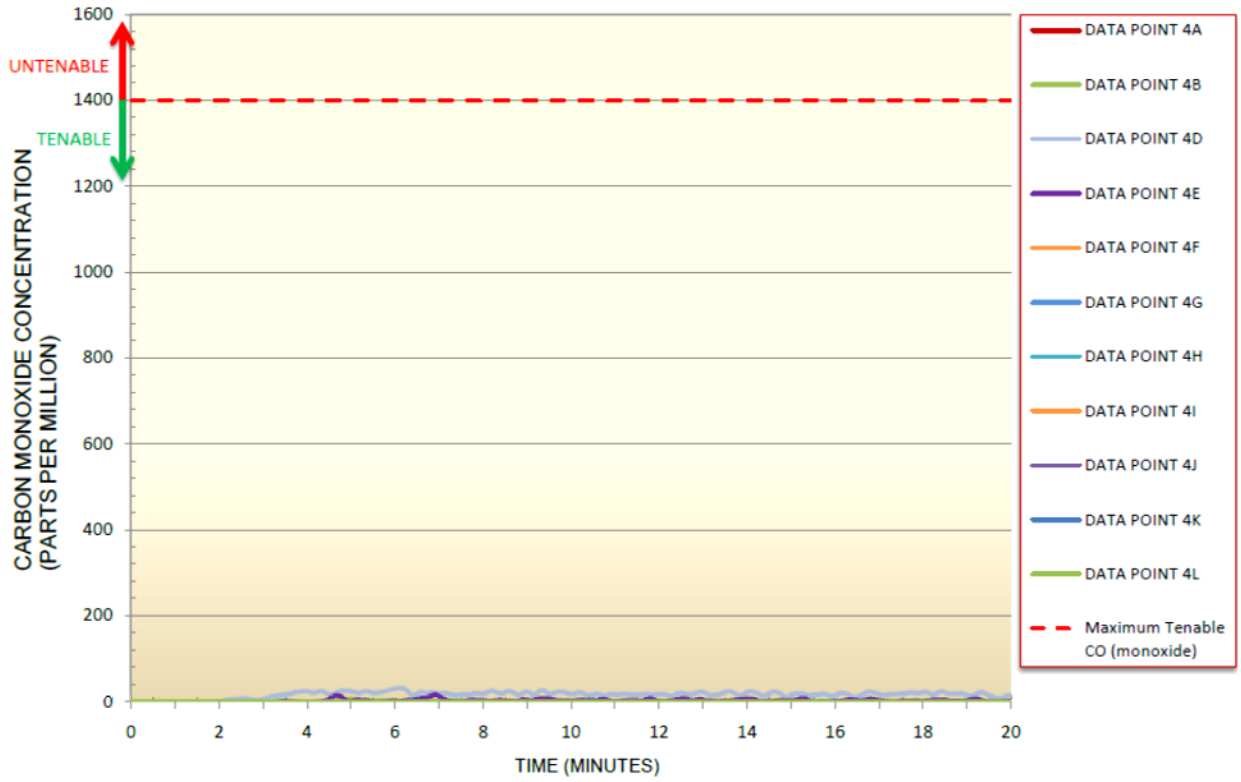
Temperature levels are maintained within tenable limits during the simulation.

Figure 3.21
Design Fire 2
Visibility Measurements at Tenability Data Collection Points
(Six Feet Elevation)



Visibility levels are maintained within tenable limits during the simulation.

Figure 3.22
Design Fire 2
Carbon Monoxide Concentration Measurements at Tenability Data Collection Points
(Six Feet Elevation)

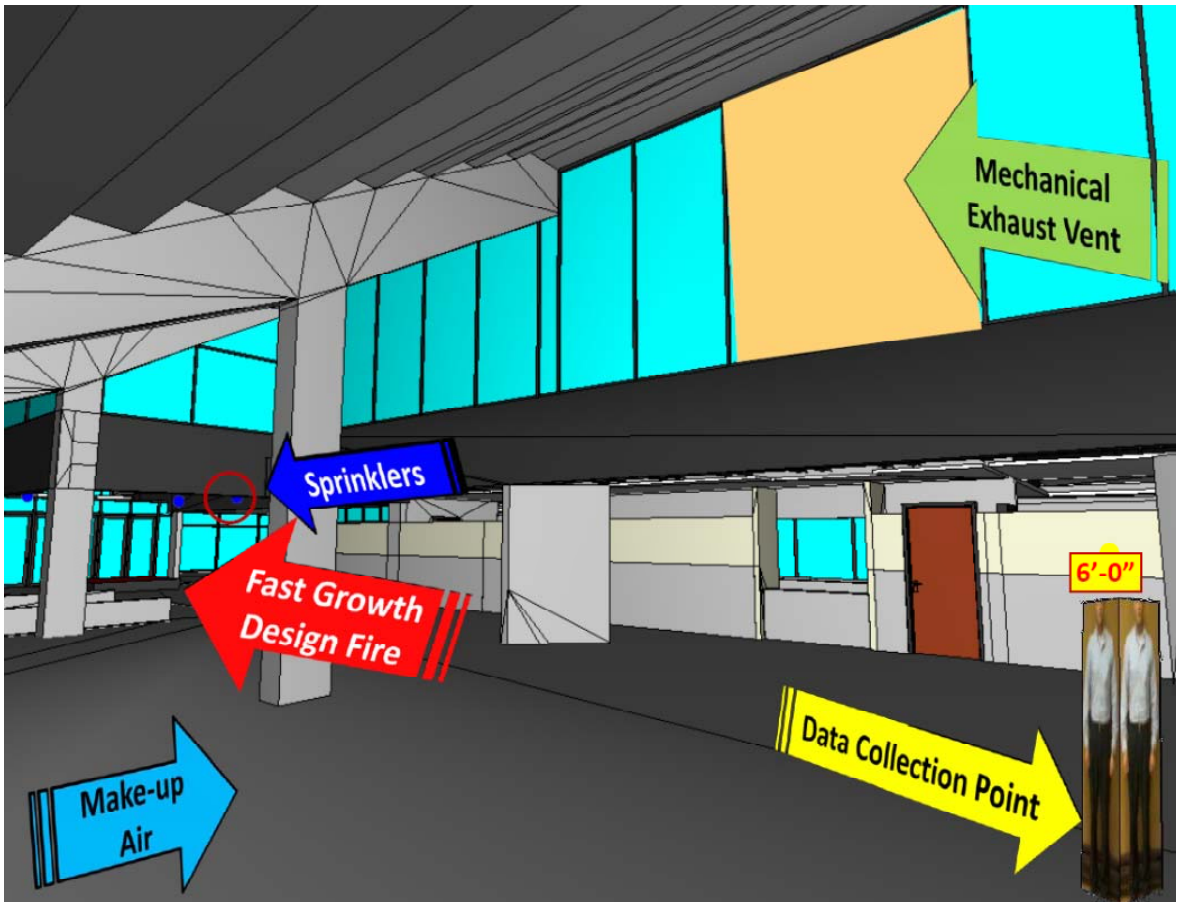


Carbon monoxide levels are maintained within tenable limits during the simulation.

3.3.3 Design Fire Scenario 3

Design Fire 3 consists of a fast growth T-squared fire located on the floor of the Main Concourse on the west end. The expected fuel load in this space could consist of kiosks filled with merchandise which typically burn slower than the fast growth T-squared rate based on test data. This fire was assumed to be sprinkler limited based on the calculations performed by the FDS software. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. The axisymmetric smoke plume provides the most concentrated smoke and was therefore the worst case scenario for sizing the exhaust fans on the Main Concourse of the Arena. The smoke control system in the Main Concourse was designed to primarily activate by automatic sprinkler activation. This scenario also modeled the worst-case external conditions of reverse stack effect conditions (summer high temperature) per Section 3.1.4.1 of this report.

Figure 3.23
Illustration Depicting Lower Level of the Cumberland County Civic Center for Design Fire 3



Note the following from the image above:

1. The location of the design fire.

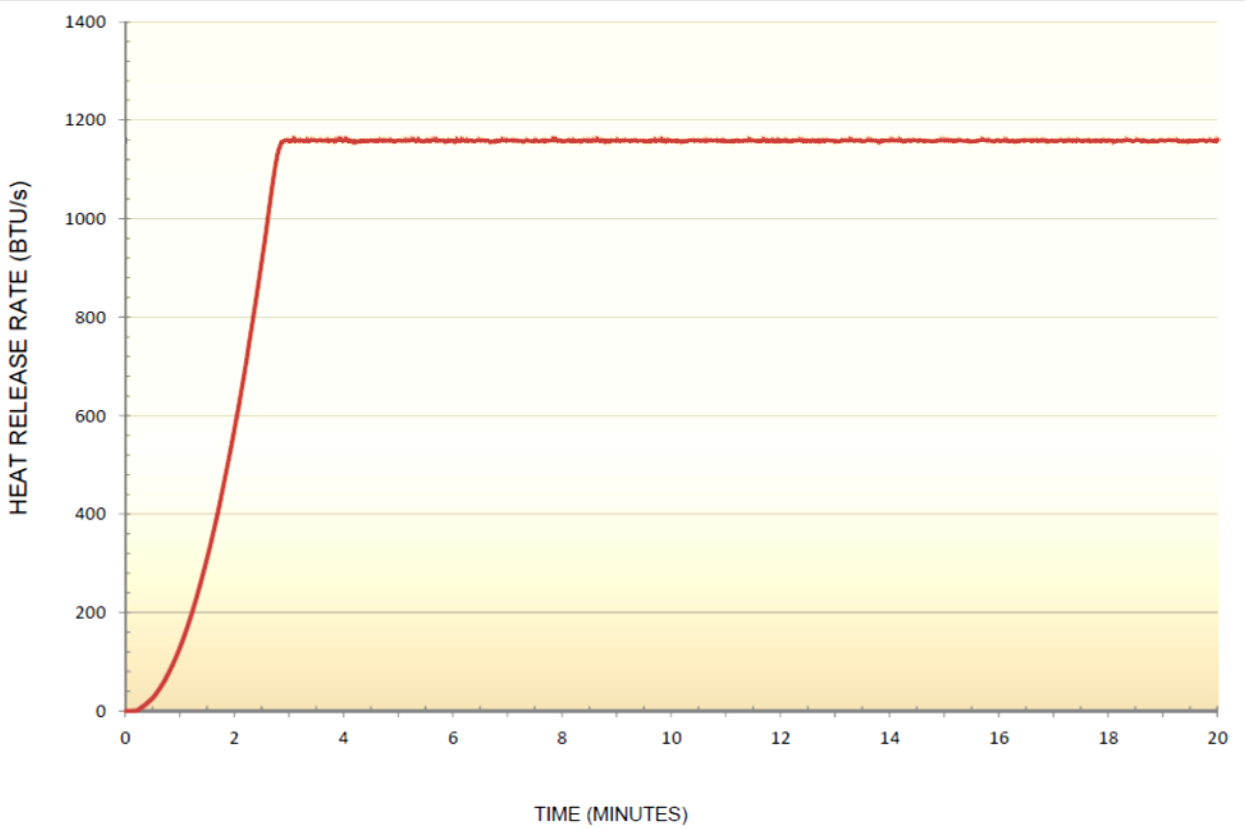
2. The mechanical exhaust vent locations (30,000 cfm each vent with two vents located in the wall of the Main Concourse). Temperature data was recorded at these vents.

3 The location of the tenability data collection points. These data collectors took measurements at six feet above the floor for temperature, visibility, and carbon monoxide concentration. See the SI.001 through SI.004 illustrations on the previous pages for additional information.

4. The locations of the automatic sprinklers are depicted. The depicted locations of these devices were meant to be representative locations used for fire and smoke modeling purposes and do not represent required locations.

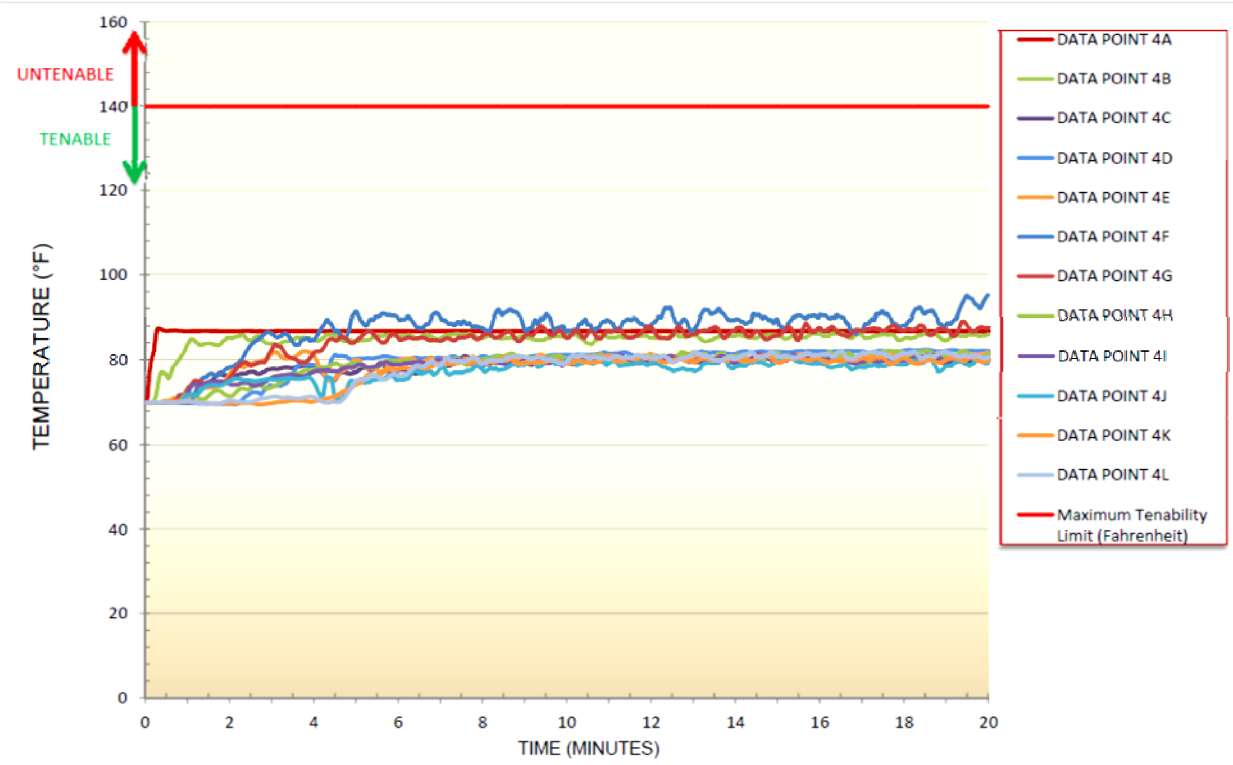
5. The location of the make-up air provided by the vomitories to the Seating Bowl (supplied from loading docks on the east end of the building).

Figure 3.24
Design Fire 3
Heat Release Rate



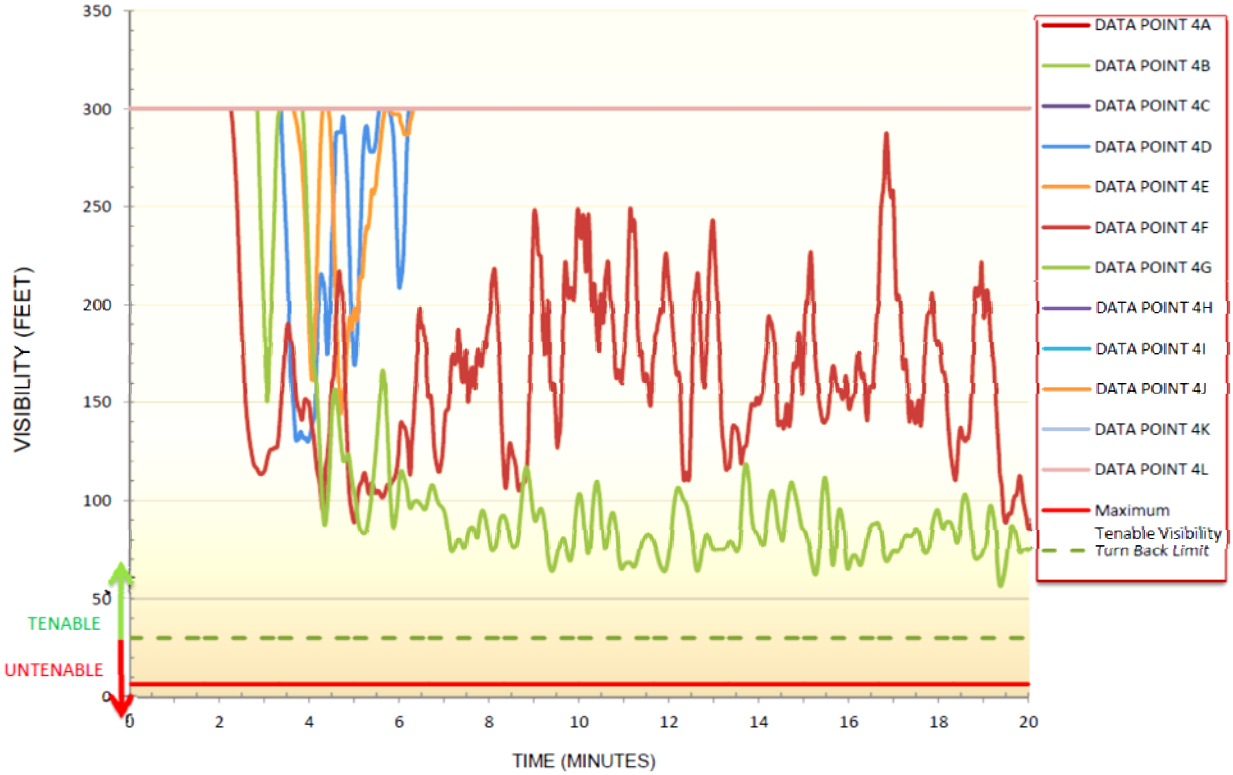
Note that the sprinkler activation temperature (165°F) is reached at approximately two and a half minutes (155 seconds) and corresponds to the point at which the design fire is controlled at a steady state heat release rate (HRR). This activation time of 155 seconds was used with the fast growth T-squared (time in seconds) fire growth model.

Figure 3.25
Design Fire 3
Temperature Measurements at Tenability Data Collection Points
(Six Feet Elevation)



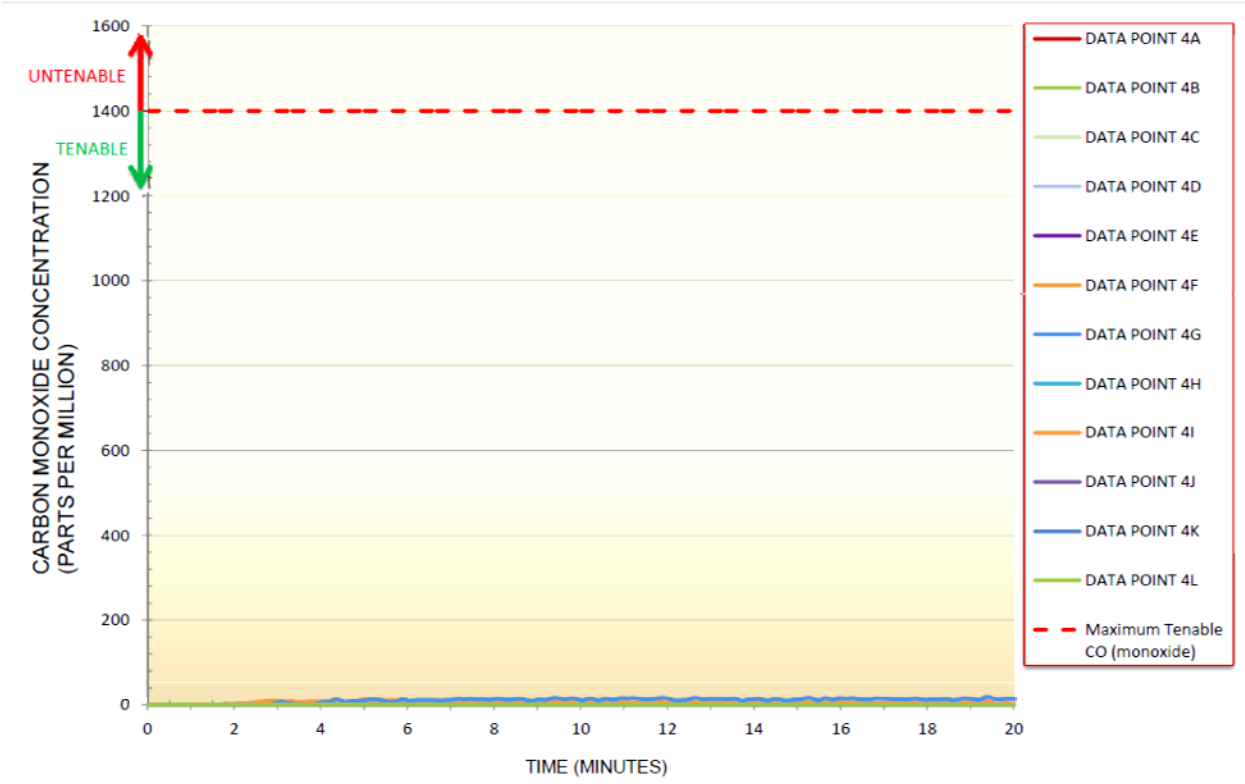
Temperature levels are maintained within tenable limits during the simulation.

Figure 3.26
Design Fire 3
Visibility Measurements at Tenability Data Collection Points
(Six Feet Elevation)



Visibility levels are maintained within tenable limits during the simulation.

Figure 3.27
Design Fire 3
Carbon Monoxide Concentration Measurements at Tenability Data Collection Points
(Six Feet Elevation)

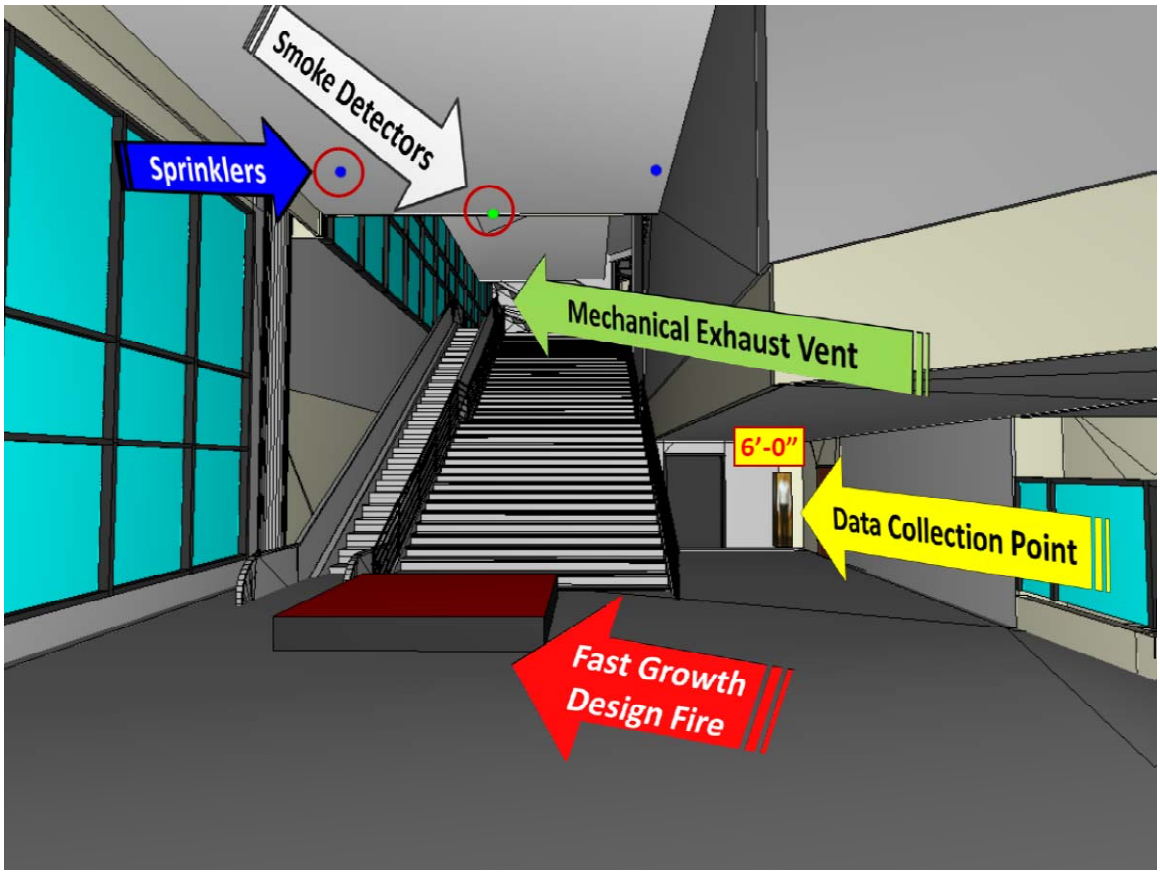


Carbon monoxide levels are maintained within tenable limits during the simulation.

3.3.4 Design Fire Scenario 4

Design Fire 4 consists of a fast growth T-squared fire located on the Mechanical Level in the communicating space that connects to the Main Concourse by an open stair. The expected fuel load in this space could consist of kiosks filled with merchandise which typically burn slower than the fast growth T-squared rate based on test data. The fire was located under the ceiling on the east side of the space away from the stair in order to create a balcony spill smoke plume. The greater amount of smoke generation possible by a balcony spill plume results because the maximum amount of air can be entrained into the smoke plume as it spills from under the ceiling of the Mechanical Level into the Main Concourse. This fire was assumed to be sprinkler limited based on the calculations performed by the FDS software. This scenario modeled the balcony spill smoke plume which provides the greatest smoke generation rate. The smoke generated by a balcony spill plume tends to be diluted compared to that of an axisymmetric plume (Design Fires 2-3) and thus this simulation was performed as a check on the ability of the smoke control system on the Main Concourse to maintain tenable conditions in this type of design fire scenario. The smoke control system for a fire on the Mechanical Level was designed to primarily activate by smoke detectors for faster response time that allows for a more efficient exhaust system. This simulation proves that the exhaust fans sized for on the axisymmetric plume from Design Fires 2-3 (Main Concourse) should be sufficient to handle a balcony spill plume. This scenario also modeled the worst-case external conditions of reverse stack effect conditions (summer high temperature) per Section 3.1.4.1 of this report.

Figure 3.28
Illustration Depicting Lower Level of the Cumberland County Civic Center for Design Fire 4



Note the following from the image above:

1. The location of the design fire.

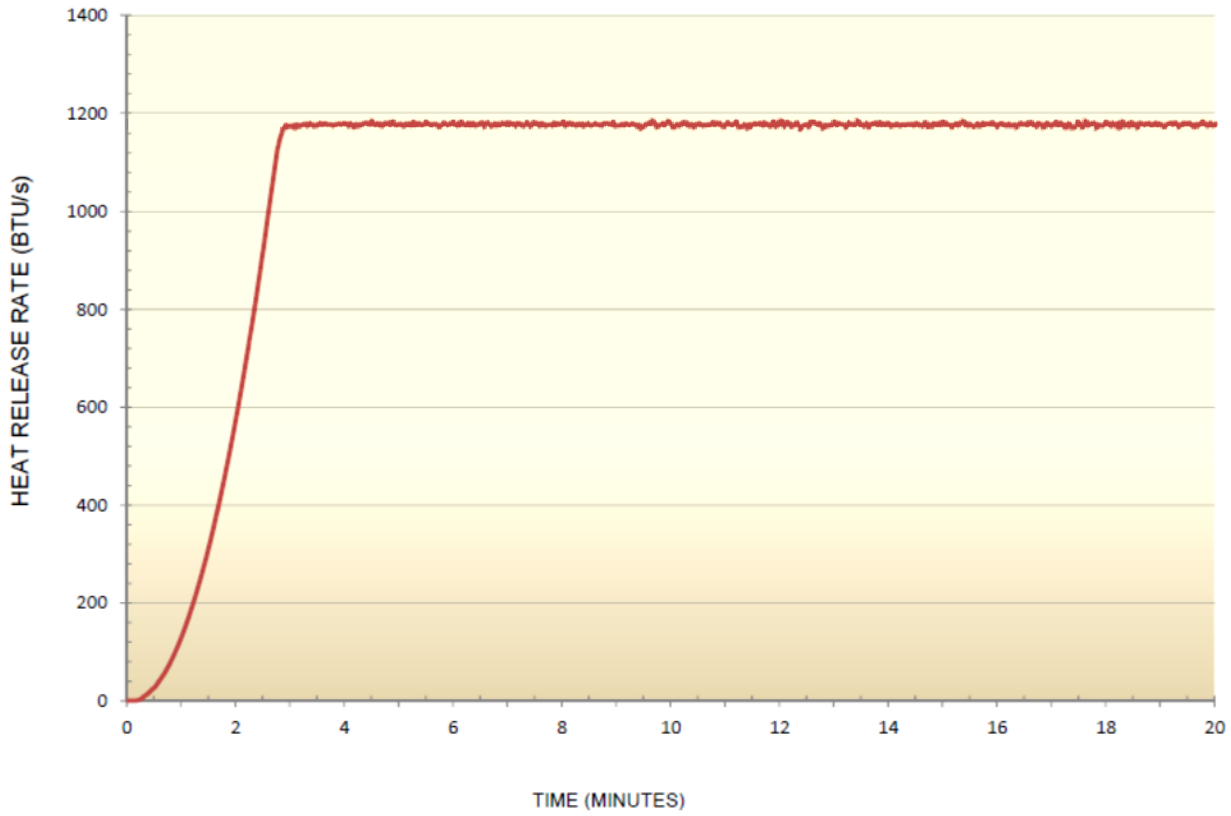
2. The mechanical exhaust vent locations. These are the same vents used for Design Fire Scenario 2 and Design Fire Scenario 3 (30,000 cfm each vent with two vents located in the wall of the Main Concourse). Temperature data was recorded at these vents.

3 The location of the tenability data collection points. These data collectors took measurements at six (6) feet above the floor for temperature, visibility, and carbon monoxide concentration. See the SI.001 through SI.004 illustrations on the previous pages for additional information.

4. The locations of the area smoke detectors and automatic sprinklers are depicted. The depicted locations of these devices were meant to be representative locations used for fire and smoke modeling purposes and do not represent required locations.

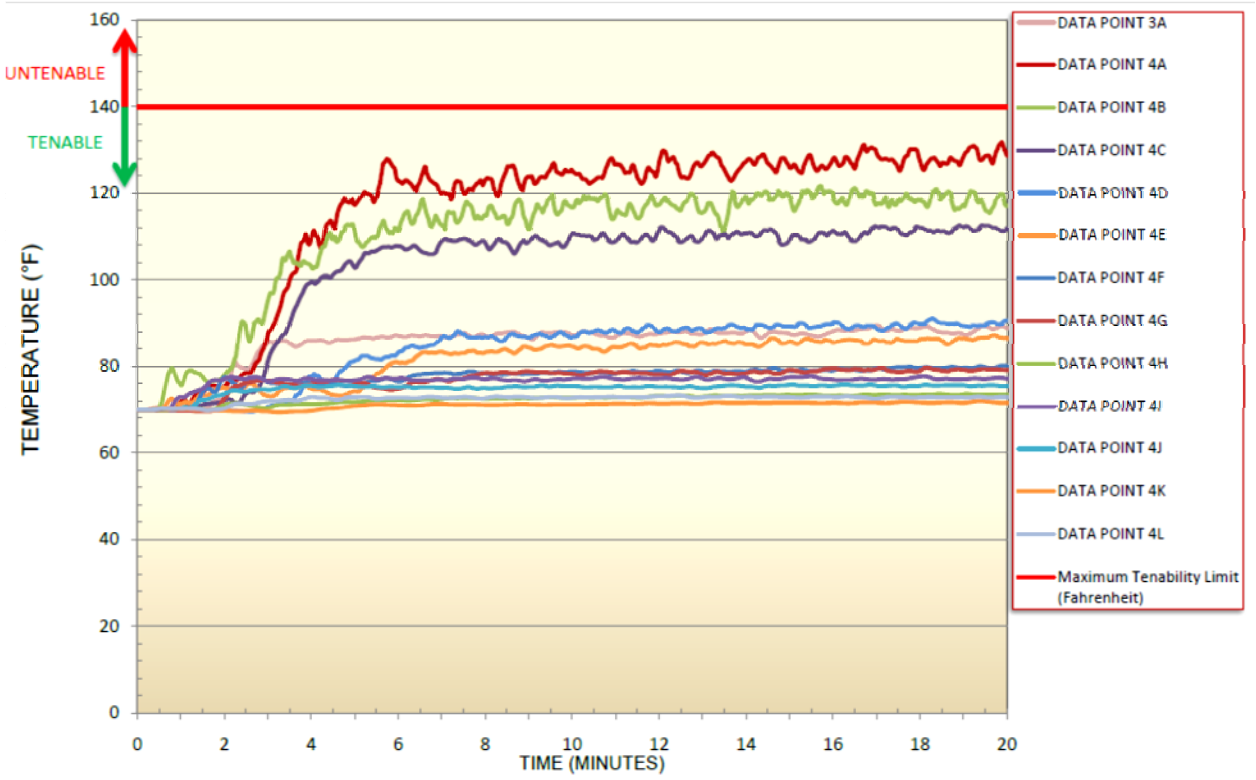
5. The location of the make-up air is not shown. Make-up air is provided by the vomitories to the Seating Bowl (supplied from loading docks on the east end of the building).

Figure 3.29
Design Fire 4
Heat Release Rate



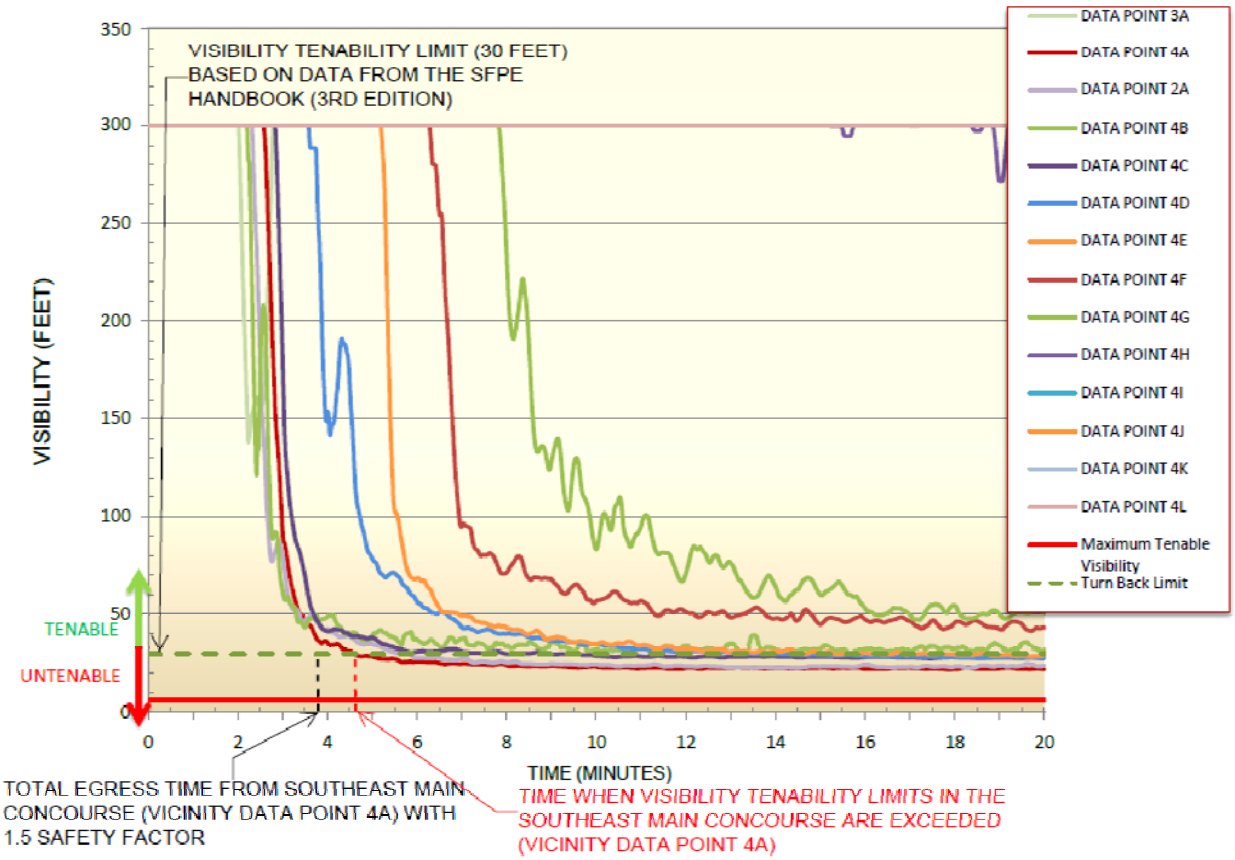
Note that the sprinkler activation temperature (165°F) is reached at approximately two and a half minutes (158 seconds) and corresponds to the point at which the design fire is controlled at a steady state heat release rate (HRR). This activation time of 158 seconds was used with the fast growth T-squared (time in seconds) fire growth model.

Figure 3.30
Design Fire 4
Temperature Measurements at Tenability Data Collection Points
(Six Feet Elevation)



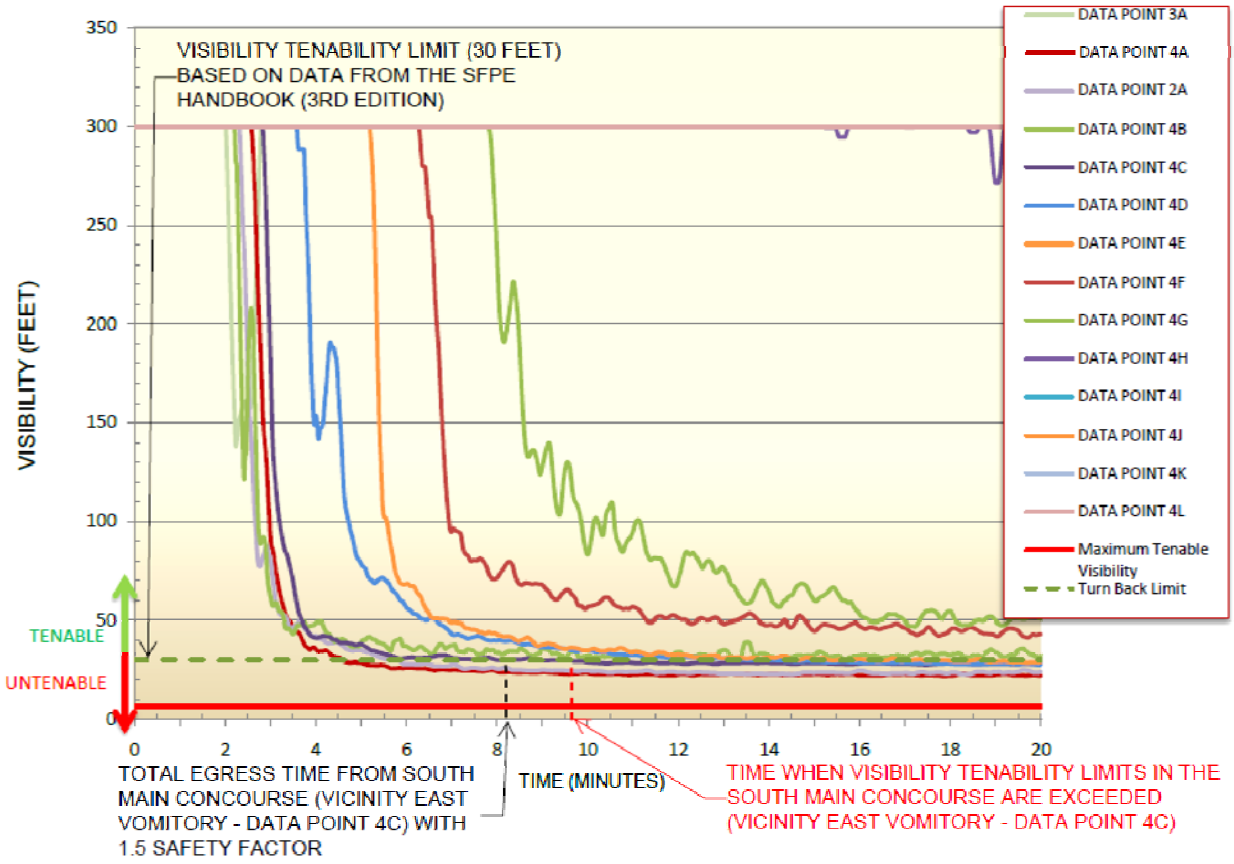
Temperature levels are maintained within tenable limits during the simulation.

Figure 3.31a
Design Fire 4
Visibility Measurements at Tenability Data Collection Point 4A
(Six Feet Elevation)



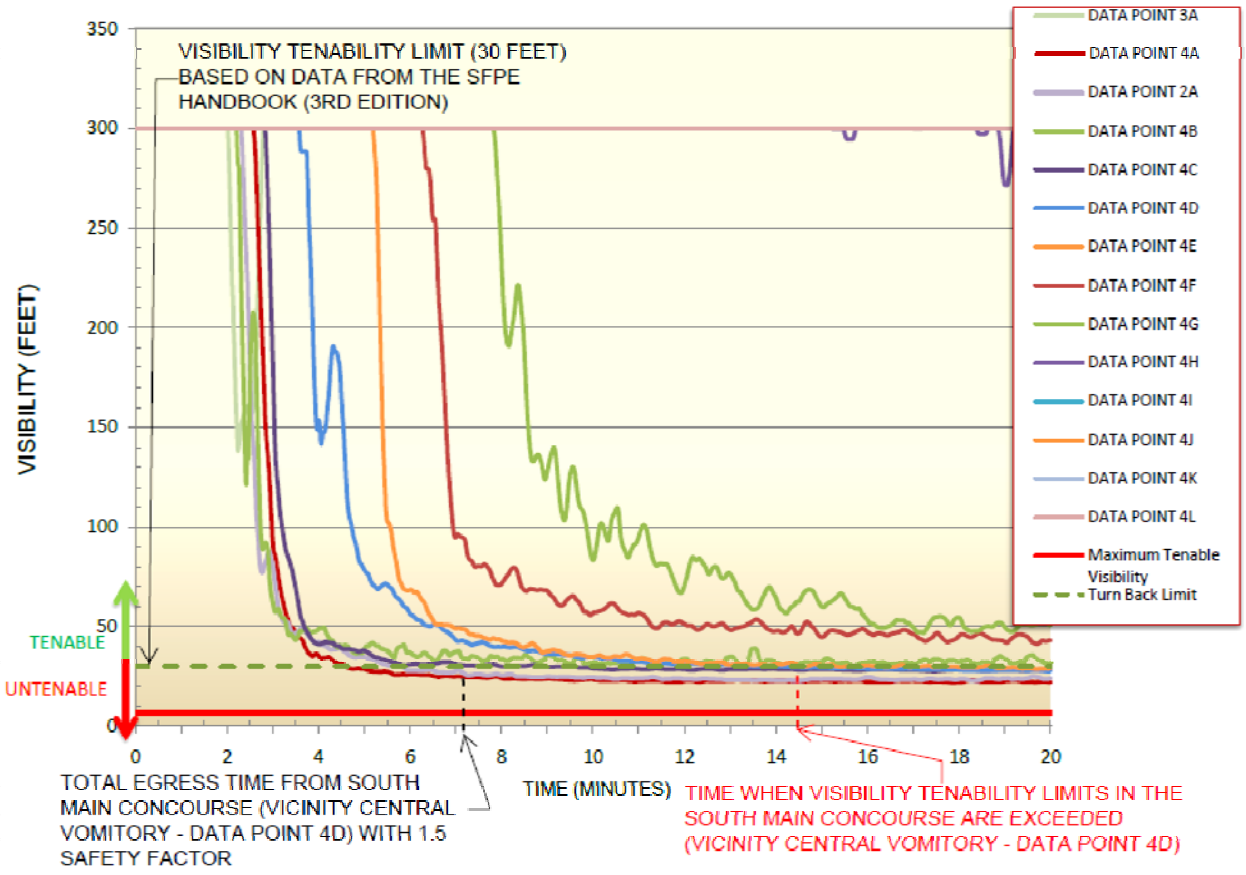
Visibility levels are maintained within tenable limits on the Main Concourse during the simulation for the duration of the required egress time (with a 1.5 safety factor). Since the total egress time multiplied by the 1.5 safety factor (3.9 minutes) is less than the time it takes for the visibility at the southeast corner of the Main Concourse in the vicinity of Data Point 4A to drop below 30 feet (4.6 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six feet above the Main Concourse in accordance with Section 909.8 of the 2009 MUBEC. Please see Section 6.1 of **Appendix B** for a further explanation of these calculations for the southeast Main Concourse.

Figure 3.31b
Design Fire 4
Visibility Measurements at Tenability Data Collection Point 4C
(Six Feet Elevation)



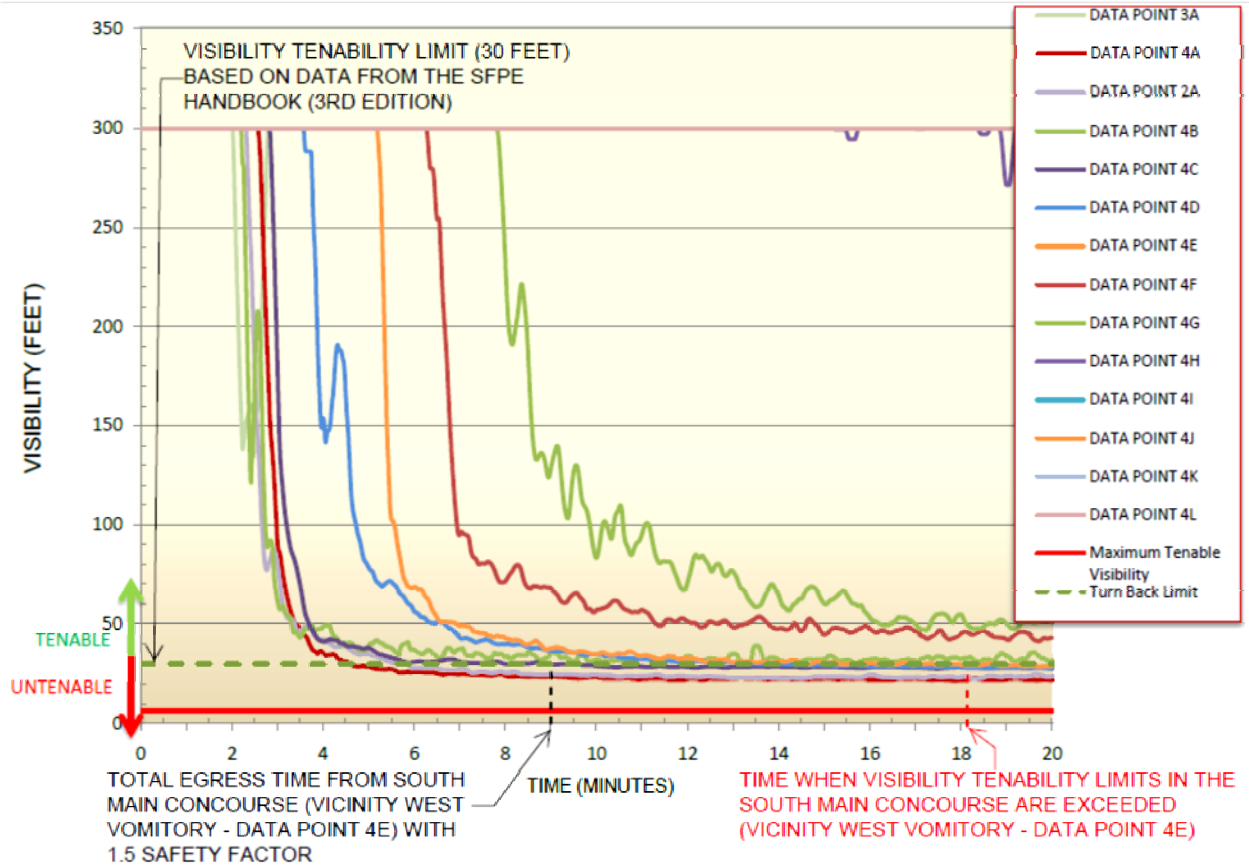
Visibility levels are maintained within tenable limits on the Mechanical Level during the simulation for the duration of the required egress time (with a 1.5 safety factor). Since the total egress time multiplied by the 1.5 safety factor for the East vomitory (8.3 minutes) is less than the time it takes for the visibility on the south Main Concourse in the vicinity of Data Point 4C to drop below 30 feet (9.7 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six (6) feet above the Main Concourse in accordance with Section 909.8 of the 2009 MUBEC. Please see Section 6.2.1 of **Appendix B** for a further explanation of these calculations for the East Vomitory.

Figure 3.31c
Design Fire 4
Visibility Measurements at Tenability Data Collection Point 4D
(Six Feet Elevation)



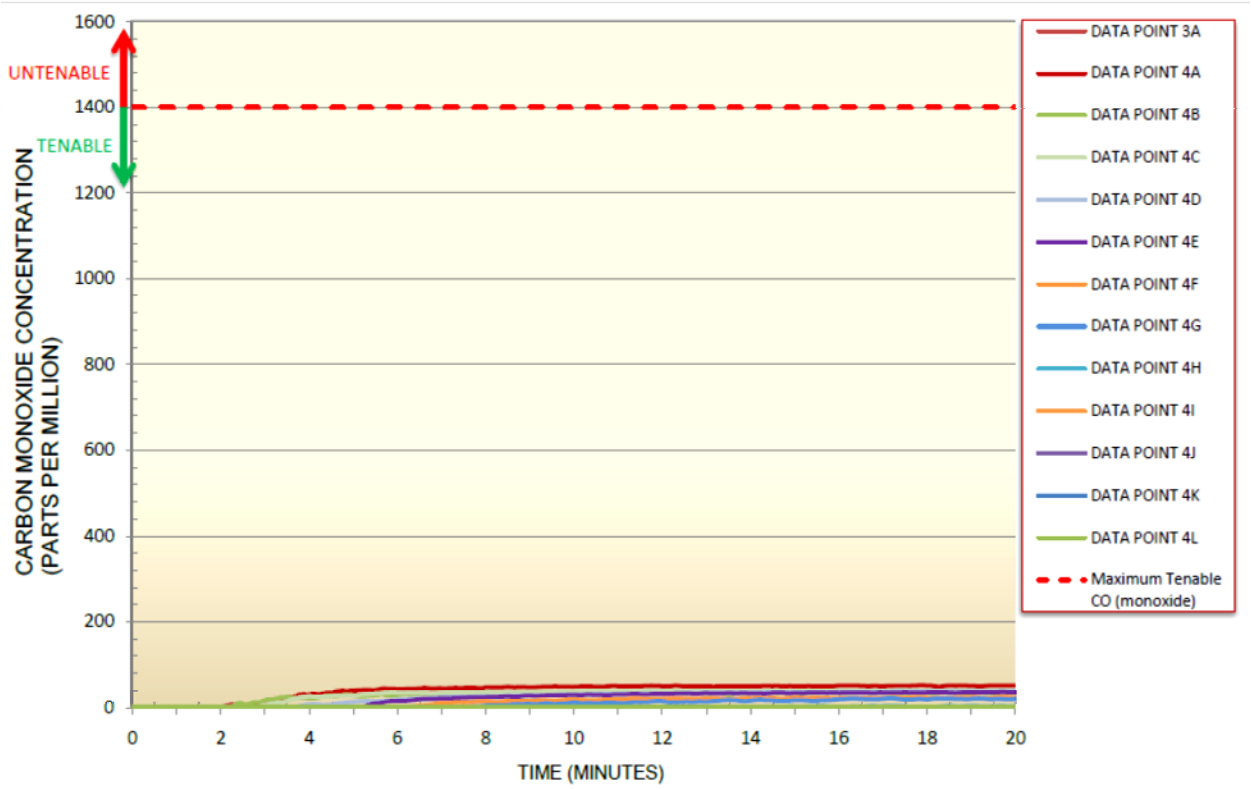
Visibility levels are maintained within tenable limits on the Mechanical Level during the simulation for the duration of the required egress time (with a 1.5 safety factor). Since the total egress time multiplied by the 1.5 safety factor for the Central vomitory (7.2 minutes) is less than the time it takes for the visibility on the south Main Concourse in the vicinity of Data Point 4D to drop below 30 feet (14.5 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six feet above the Main Concourse in accordance with Section 909.8 of the 2009 MUBEC. Please see Section 6.2.2 of **Appendix B** for a further explanation of these calculations for the Central Vomitory.

Figure 3.31d
Design Fire 4
Visibility Measurements at Tenability Data Collection Point 4E
(Six Feet Elevation)



Visibility levels are maintained within tenable limits on the Mechanical Level during the simulation for the duration of the required egress time (with a 1.5 safety factor). Since the total egress time multiplied by the 1.5 safety factor for the West vomitory (9.0 minutes) is less than the time it takes for the visibility on the south Main Concourse in the vicinity of Data Point 4E to drop below 30 feet (18.1 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six feet above the Main Concourse in accordance with Section 909.8 of the 2009 MUBEC. Please see Section 6.2.3 of **Appendix B** for a further explanation of these calculations for the West Vomitory.

Figure 3.32
Design Fire 4
Carbon Monoxide Concentration Measurements at Tenability Data Collection Points
(Six Feet Elevation)

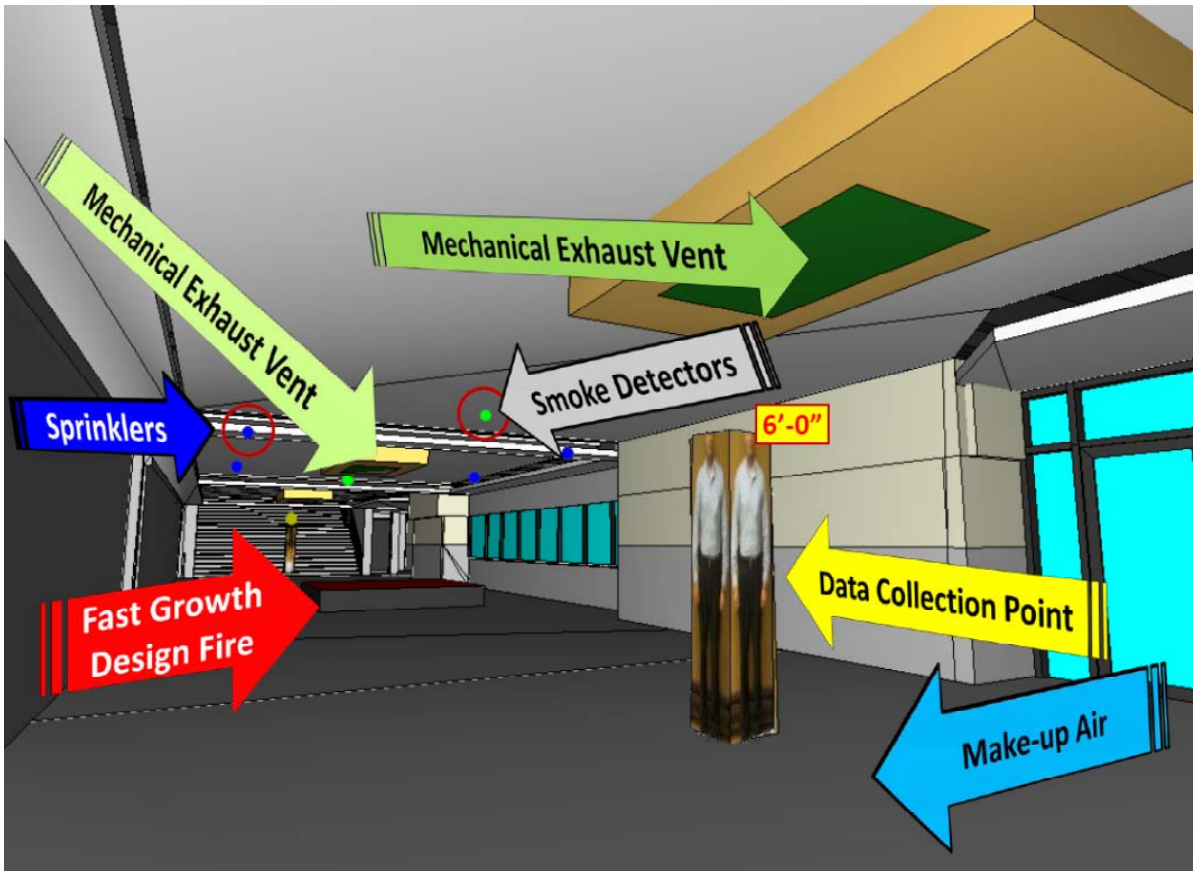


Carbon monoxide levels are maintained within tenable limits during the simulation.

3.3.5 Design Fire Scenario 5

Design Fire 5 consists of a fast growth T-squared fire located on the floor of the West Lobby on the west end of the Main Concourse. The expected fuel load in this space could consist of kiosks filled with merchandise or furniture which typically burn slower than the fast growth T-squared rate based on test data. This fire was assumed to be sprinkler limited based on the calculations performed by the FDS software. This configuration creates an axisymmetric smoke plume and the fire located away from any walls produces the largest amount of concentrated smoke for this smoke plume model as the maximum amount of air can be entrained into the smoke plume. The axisymmetric smoke plume provides the most concentrated smoke and was therefore the worst case scenario for sizing the exhaust fans on the floor of the Lobby on the west end of the Main Concourse. This design fire scenario also creates a balcony spill plume scenario that affects the stairs that are open directly to the north of the lobby. The smoke control system in the West Lobby was designed to primarily activate by smoke detectors for faster response time that allows for a more efficient exhaust system. This scenario also modeled the worst-case external conditions of reverse stack effect conditions (summer high temperature) per Section 3.1.4.1 of this report.

Figure 3.33
Illustration Depicting Lower Level of the West Lobby of the Cumberland County Civic Center for Design Fire 5



Note the following from the image above:

1. The location of the design fire.

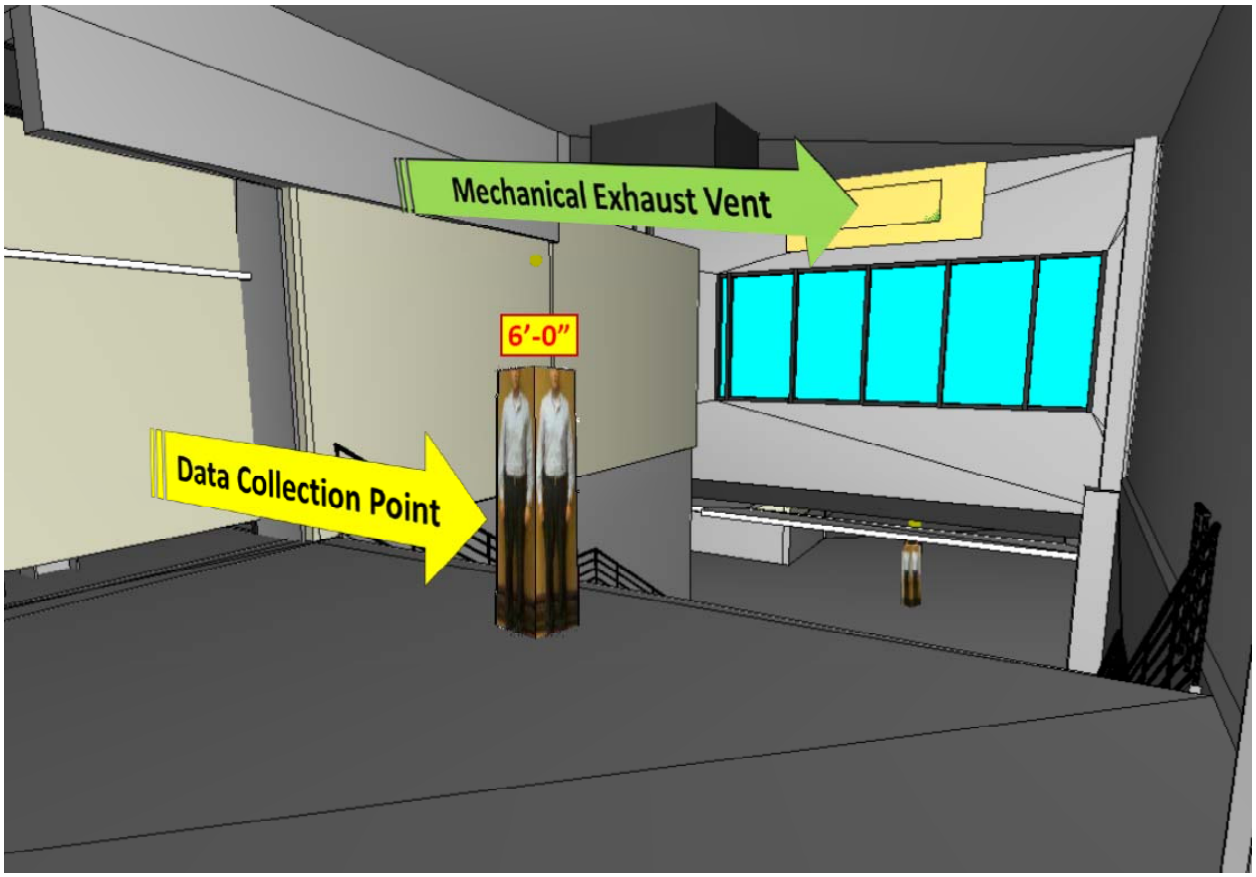
2. The mechanical exhaust vent locations are shown (15,000 cfm each vent with three vents located in the ceiling of the Lobby). Temperature data was recorded at these vents.

3 The location of the tenability data collection points. These data collectors took measurements at six feet above the floor for temperature, visibility, and carbon monoxide concentration. See the SI.001 through SI.004 illustrations on the previous pages for additional information.

4. The locations of the area smoke detectors and automatic sprinklers are depicted. The depicted locations of these devices were meant to be representative locations used for fire and smoke modeling purposes and do not represent required locations.

5. The location of the make-up air is shown. Make-up air is provided by the doors that connect to the Main Concourse (supplied from loading docks on the east end of the building).

Figure 3.34
Illustration Depicting Top Stair in Northeast Corner of the Cumberland County Civic Center for Design Fire 5

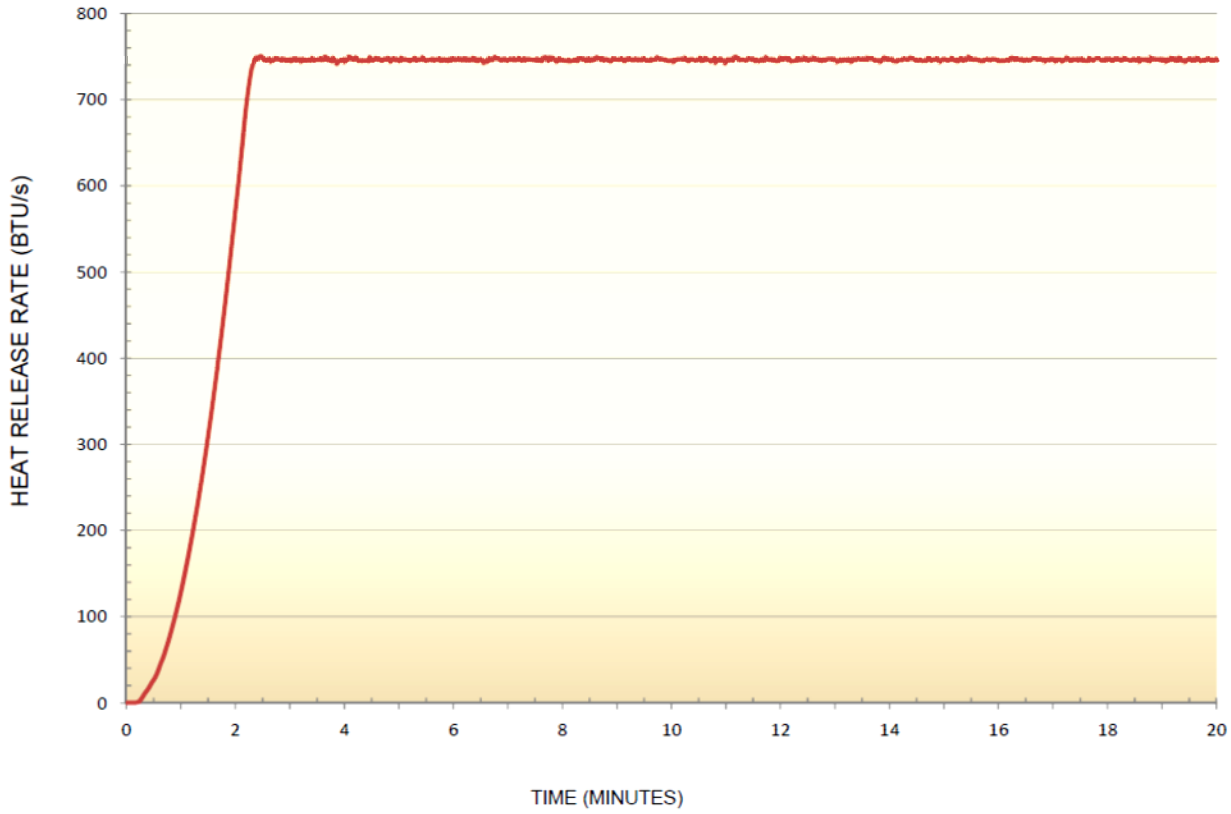


Note the following from the image above:

1. The mechanical exhaust vent location are shown (10,000 cfm vent located in the stair connected to the West Lobby). Temperature data was recorded at this vent.

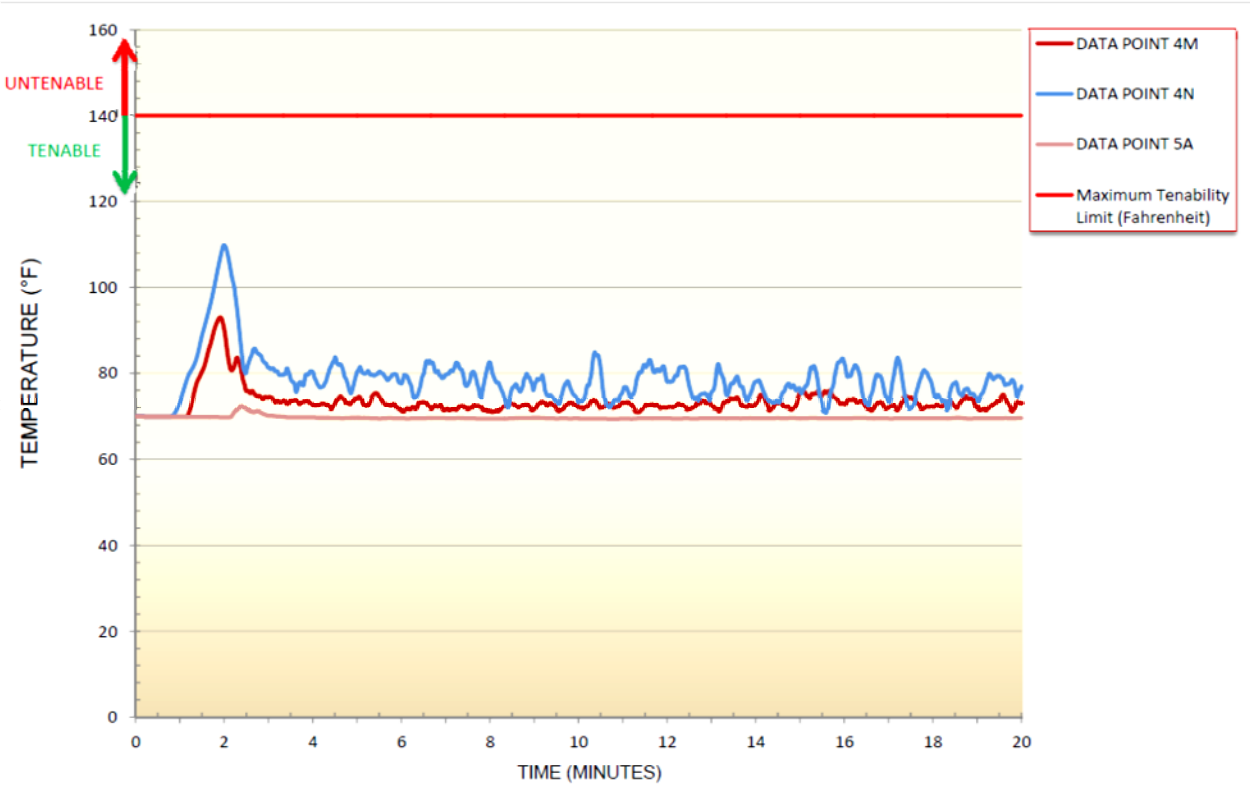
2. The location of the tenability data collection point in the stair. This data collector took measurements at six (6) feet above the floor for temperature, visibility, and carbon monoxide concentration. See the SI.001 through SI.004 illustrations on the previous pages for additional information.

Figure 3.35
Design Fire 5
Heat Release Rate



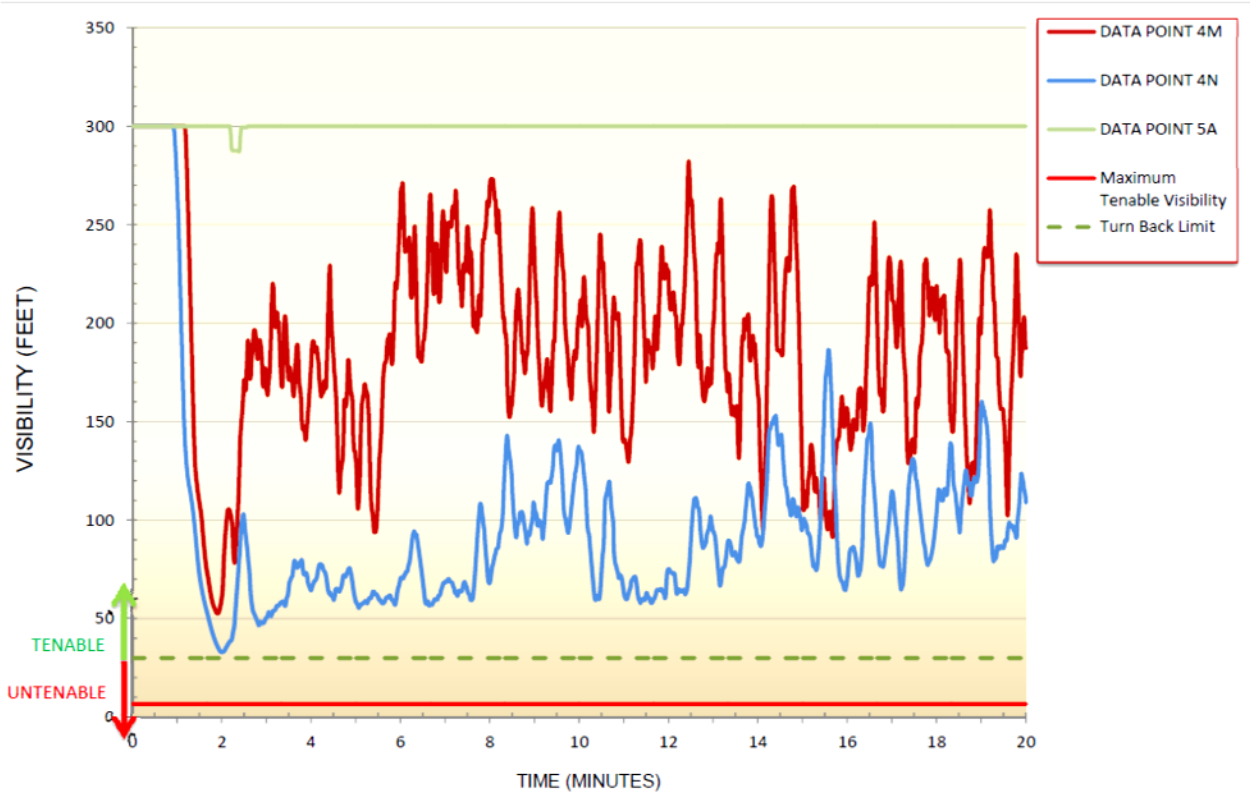
Note that the sprinkler activation temperature (165°F) is reached at approximately two minutes (131 seconds) and corresponds to the point at which the design fire is controlled at a steady state heat release rate (HRR). This activation time of 131 seconds was used with the fast growth T-squared (time in seconds) fire growth model.

Figure 3.36
Design Fire 5
Temperature Measurements at Tenability Data Collection Points
(Six Feet Elevation)



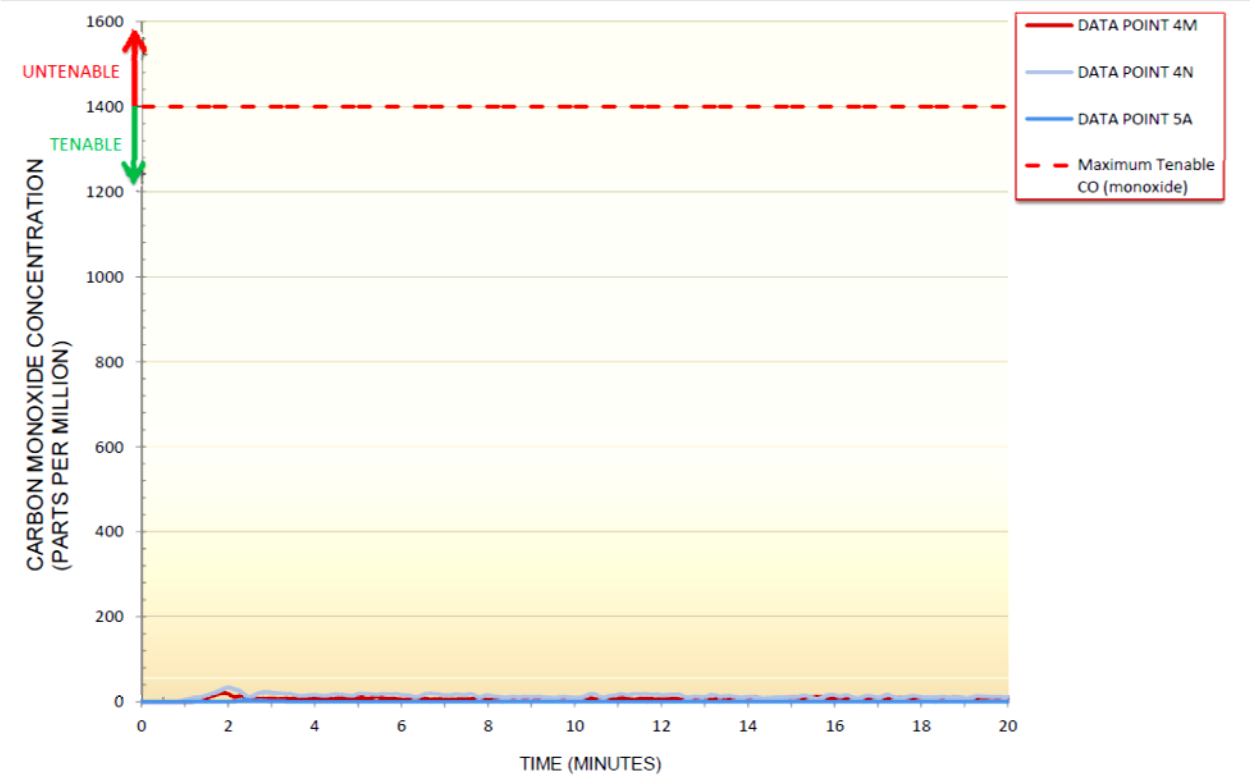
Temperature levels are maintained within tenable limits during the simulation.

Figure 3.37
Design Fire 5
Visibility Measurements at Tenability Data Collection Points
(Six Feet Elevation)



Visibility levels are maintained within tenable limits during the simulation.

Figure 3.38
Design Fire 5
Carbon Monoxide Concentration Measurements at Tenability Data Collection Points
(Six Feet Elevation)



Carbon monoxide levels are maintained within tenable limits during the simulation.

4.0 CONCLUSION

The purpose of the mechanical smoke control system in the Cumberland County Civic Center is to control the accumulation of smoke in the Arena in order to maintain tenable conditions six feet above the highest level of egress in order to allow Arena occupants sufficient time to exit through the Arena. The proposed smoke control system achieves this objective.

APPENDIX A

FIRE MODELING DISCUSSION

FIRE MODELING DISCUSSION

Fire modeling is used to depict possible fire scenarios, to predict fire growth and the amount of combustion products formed, and to estimate the amount of time that a space may remain tenable. Results of all depicted fire scenarios are documented.

The following discussion documents the methodology of the fire modeling calculations for this project and includes the following topics:

- Fire growth models and their limitations - in particular, Fire Dynamics Simulator (FDS), the fire model used for this analysis
- Standard T-squared fire growth, including fire sizes and fuel sources
- Tenability

Fire Growth Models

Fire growth models are defined as mathematical procedures developed to estimate the change in the environment of a space or building caused by the existence of a fire in that space that varies in intensity and/or area of involvement with time. There are two types of fire growth models: zone models and field models.

Zone Models

A single-compartment zone type of fire model divides the room into two control volumes - a hot upper smoke layer and a cooler fresh air lower layer - and solves conservative equations for these regions. Key conditions (temperature, gas concentrations, etc.) are determined in each layer as a function of time. Zone models are a proven method of providing practical first-order estimates of fire processes in enclosures.

Field Models

In a field model, the space being evaluated is subdivided by a grid into many nodes at which gas properties, including temperature and velocity, are calculated, allowing the space to be examined in greater detail. As a result, the output of a field model shows the levels of gas properties changing gradually in the atmosphere as opposed to the zone model which has a sharp demarcation between the smoke layer and fresh air layer. FDS is a field model, which utilizes a computational fluid dynamics (CFD) method, to model fire driven fluid flow. This type of model requires the use of a large-capacity computer, requires extensive time and expertise to set up and run, and is much more costly than using a zone model. This type of model is best suited for use when evaluating irregular, complex spaces requiring a very high level of detail.

Fire Dynamics Simulator

The FDS computer program and its associated routines were developed by the Building and Fire Research Laboratory (BFRL) Division at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland (formerly the Center for Fire Research at the National Bureau of Standards), with significant support from the General Services Administration. The FDS program is a field model which addresses fire development in buildings, the resulting conditions, and the response of fire protection systems. The program operates on a variety of computing platforms and the version used for this study is Version 5 released in September 2004, which is available from NIST.

FDS requires the following input: the geometry and material of the enclosure, a description of the initiating fire and the parameters for the smoke exhaust fans and make-up air vents. Parameters for the smoke exhaust fans and vents include position, dimension of openings, and volume flow rates. The information which may be generated from this computer model is the flow of smoke from openings; the response of heat activated detection devices, such as sprinklers and smoke detectors; the gradients of temperature, oxygen, carbon monoxide, and carbon dioxide concentrations in the atmosphere; and the effects of available oxygen on combustion.

The FDS program represents state-of-the-art approaches currently available for evaluating the life safety characteristics of buildings. The documentation for these programs indicates that the results are accurate for small rooms and buildings, as well as for larger spaces.

Standard T-Squared Fire Growth

Both simulators use a T-squared fire growth model, which is the fire growth model most commonly recognized in the fire protection industry. A T-squared fire is one whose heat output quadruples as its duration doubles. This model represents the growth rate of fires involving a wide range of commodities and arrangements. While the growth rate of fires involving different types of combustibles is similar, the actual heat output of fires involving those commodities can vary significantly. For instance, separate fires involving a bag of newspapers and a truck full of Styrofoam packing peanuts will both grow in T-squared fashion but the heat output of the plastic fire will be much greater than the newspaper fire in any given amount of time.

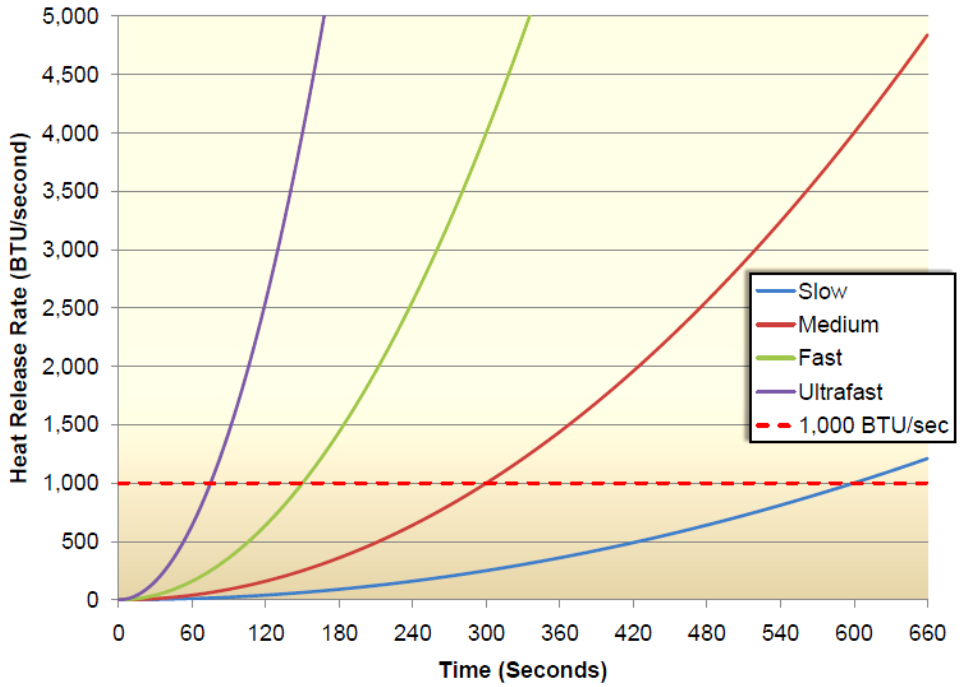
The T-squared growth model is an accepted fire protection industry standard. It assumes a fire continues to grow to a size and burn indefinitely. In reality, fires experience a period of growth, stabilize at some burning rate (which is affected by the amount of available air for combustion, etc.), then experience a period of decline until all available energy has been released. Fire models for enclosed spaces; reflect the effect of sprinklers on the growth of the fire. After sprinklers activate, the fire is assumed to no longer increase in size, as is permitted by code.

Fire Types

Fires are generally classified based upon their initial growth, specifically the time required for them to reach a heat release rate of 1,000 BTU/second [1,055 kW].

Type of Fire	Time to Reach 1,000 BTU/second [1,055 kW]
Slow	600 seconds
Moderate	300 seconds
Fast	150 seconds
Ultra Fast	75 seconds

Figure A.1
Standard Fire Model Growth Rate Curves



A "slow" fire represents a fire involving materials with a low level of combustibility. A "moderate" fire represents ordinary combustible materials, such as wood stacked and arranged. A "fast" fire represents a mix of ordinary combustibles and plastics in an arrangement which promotes fast burning. "Ultra fast" describes the fire growth rate of many plastics and some combustible liquids.

A "fast" fire represents a condition that might be expected in the spaces analyzed. The standard "fast" fire growth closely resembles a fire allowed to grow uncontrolled in a five foot high stack of wood pallets with 6-12% moisture

content with the potential to release an unlimited amount of energy as if pallets were continually added. Other examples of fast fires include paper cartons in rack storage on pallets, 15-30 feet high; filled polyethylene letter trays, stacked five feet high; polystyrene tubs and toys stacked to approximately 15 feet high. The latter example can represent kiosks that are expected to be found in the spaces analyzed.

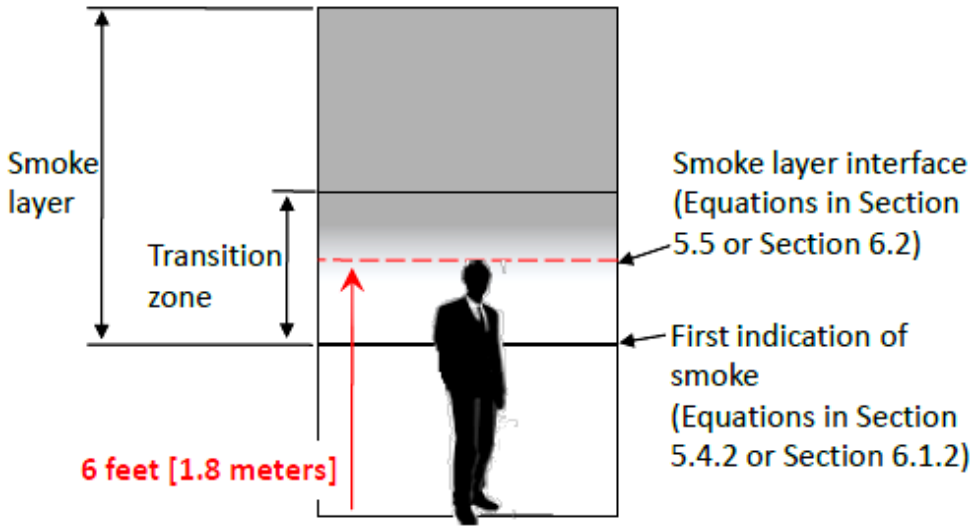
Tenability

Fire modeling of a space (using computational fluid dynamics [CFD] field fire models) may be used to analyze a proposed smoke management system in accordance with the [model building code] which references the 2005 Edition NFPA 92B *Smoke Management Systems in Malls, Atria, and Large*.

Section 5.1.3 of the 2005 Edition NFPA 92B permits the use of CFD fire models for smoke management systems analysis. Using a CFD fire model to determine if the occupants will be able to exit the space in an acceptably safe (tenable) atmosphere where smoke may be present is permitted in Section 3.3.21 of the 2005 Edition NFPA 92B.

By contrast, zone models such as the Fire Simulator or the algebraic equations found in Section 6.2 of the 2005 Edition NFPA 92B determine the smoke layer interface at a certain height above the highest level of egress access or some other design reference location. It should be noted that even for these calculations, some smoke may be present as these calculation methods define the smoke layer interface in the transition zone of the smoke layer (the point where the cool fresh air layer below the smoke transitions to the smoke layer) as illustrated in Figure A.2 below (taken from Figure A.3.3.8 of the 2005 Edition NFPA 92B).

Figure A.2
First Indication of Smoke from Figure A.3.3.8 of the 2005 Edition NFPA 92B



If the desired smoke layer interface (located within the transition zone) is not directly determined as is common in CFD field fire modeling, then maintaining tenable conditions up to a height of six feet above

the highest egress surface level is used. The effect of asphyxiants is due to the concentration of the dose, in addition to the amount of time exposed to that dose. Tenability criteria, which are based upon temperature, visibility (optical density of the smoke), and gas concentrations, are examined as the benchmark of acceptability.

It should be noted that the FDS program does not document the concentration of all combustion products. It has been shown that well ventilated fires (such as the ones modeled in this analysis), tend to destroy organic irritants and that the toxicity of the smoke is most likely to be a result of combustion products, such as carbon monoxide. Carbon monoxide is approximately twenty times more toxic than carbon dioxide. Well ventilated fires, as well as fires in the early stage of development, yield efficient combustion and a low production of carbon monoxide. The exception to this is fire retardant materials. The burning of fire retardant materials, even in well ventilated fires, will produce a low carbon dioxide to carbon monoxide ratio. This means that the toxicity level of carbon monoxide, in relation to the other products of combustion, will be reached sooner than with non-fire retardant materials. Generally, if the carbon monoxide levels are found to be at acceptable tenability levels, then the carbon dioxide and oxygen levels are also found to be within tenable limits as well. These values were recorded but not included in our report graphs.

The limits given below are used as tenability criteria for egress analysis:

THREAT	TENABILITY LIMIT	SOURCES
Temperature	• Maximum 140°F (60°C) exposure less than 30 minutes • Maximum 212°F (100°C) exposure less than 12 minutes	(1)
Carbon Monoxide (CO)	Maximum 1,400 ppm (0.14%) exposure less than 30 minutes	(2)
Visibility (Optical Density) [OD]	0.5 OD/m (Allows visibility as low as 2m or 6.6 feet); 30 feet minimum visibility for turn back	(3,4,5)

REFERENCES

1. Toxicity Assessment of Combustion Products, SFPE Handbook of Fire Protection Engineering, Third Edition, 2002; Table 2-6.19; p2-129.

2. Toxicity Assessment of Combustion Products, SFPE Handbook of Fire Protection Engineering, Third Edition, 2002; Table 2-6B (a); p.2-165.

3. National Institute of Standards and Technology, Handbook 146, Volume II, Technical Reference Guide for the HAZARD I Fire Hazard Assessment Method, Building and Fire Research Laboratory, June 1991.

4. Babrauskas, V., Technical Note 1103. National Bureau of Standards, 1979.

5. Hazard Calculation, SFPE Handbook of Fire Protection Engineering, Third Edition, 2002; Table 3-12.20; p3-334.

APPENDIX B

TIMED EGRESS ANALYSIS

B.1 TIMED EGRESS ANALYSIS – DESIGN FIRE 1 [SEATING BOWL]

A timed egress analysis is presented to demonstrate that the occupants of the Seating Bowl of the Cumberland County Civic Center can exit from the Seating Bowl before the visibility recorded at data points 1E and 2E (six feet above the highest seats in the Seating Bowl) drops below 30 feet as referenced by Appendix A of this report (the tenability limit for visibility based on data from studies referenced in the Society of Fire Protection Engineers Handbook). Below are the calculations for the total required egress time:

1. Methodology

The exit rate calculations used in this analysis are similar to the flow rates found in Dr. John Fruin's work, Pedestrian Planning and Design as a Level of Service "E" referenced in Chapter 14, Section 3 of the Society of Fire Protection Engineers (SFPE) Handbook of Fire Protection Engineering, 3rd Edition. The flow rates and travel speeds used in this study are conservative and are consistent with emergency exiting considerations. During non-emergency conditions, many persons exit at their leisure and exit times longer than those reported in this study are expected. Studies indicate the human behavior known as panic is rare and does not occur if adequate exits are provided.

The flow rate used for persons traveling through doors or on level accessways is on the lower end of the range provided by Fruin.

The following flow rates and travel speeds have been used:

Table B.1.1
Travel Speeds and Flow Rates

ELEMENT	TRAVEL SPEED IN FEET/MINUTE (ft/m)	FLOW RATE IN PEOPLE/FEET/MINUTE (pfm)
Stairs & stepped aisles (7 inch risers)	60.0 (slow); 100.0 (fast)*	17.0
Stairs & stepped aisles (8 inch risers)	35.0 (slow); 80.0 (fast)*	15.3
Doors	-----	21.0
Seating Rows	35.0 (slow); 80.0 (fast)*	-----
Level exit components	150 (slow); 200 (fast) *	21.0

** The faster speed is used to consider the time for the first person to reach an exit (i.e., the lead person in a crowd). The slower speed is used to address the movement expected by the elderly, persons with disabilities and the last person in a crowd.*

2. Definitions

The following terms are defined to provide clarity:

Queue (Queuing) - Pedestrian waiting condition where forward movement essentially stops and people become stationary for a period of time.

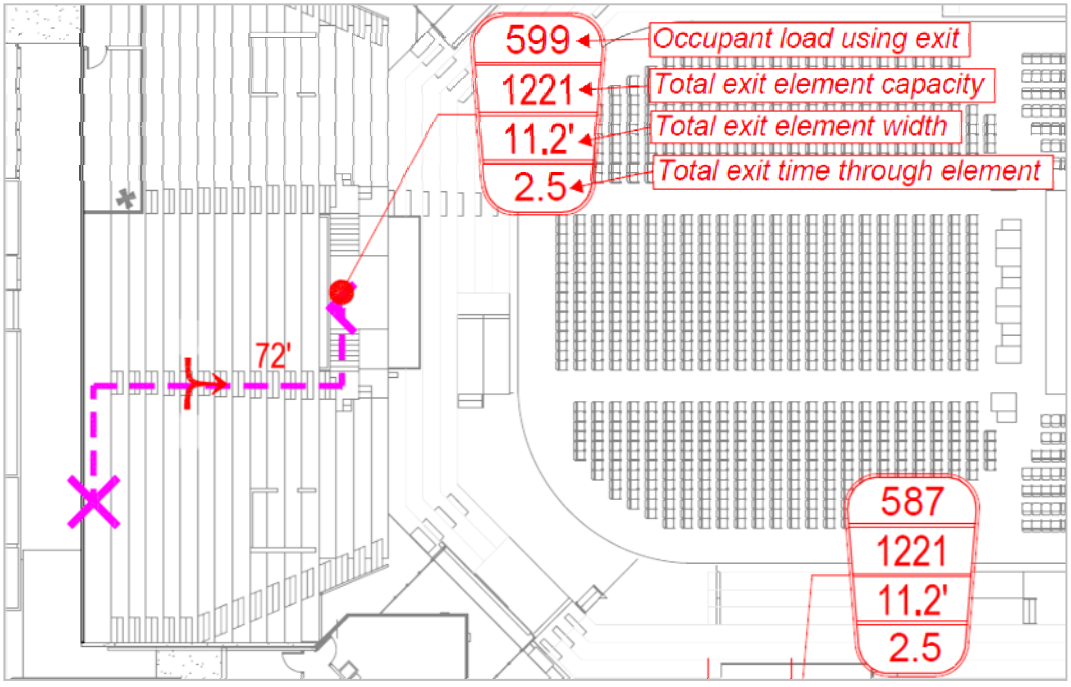
Flow Time - This is the amount of time for a population to pass a particular point.

Egress Time - This is the total time for a population to traverse across a space and includes both the flow time through a point and the travel time to an exit element.

3. Population

The exit analysis uses the populations calculated from the Seating Bowl seating section manifests. The largest population of the Seating Bowl section with the longest travel distance is 599 people (see Figure B.1.1 below). The Seating Bowl opens into the Main Concourse through vomitories located midway up the Seating Bowl from the Event Level. It was considered that once an occupant could reach and pass through a vomitory then the timed egress analysis is complete as the Main Concourse was assumed to be an egress path clear of smoke.

Figure B.1.1
Travel Distances in the Seating Bowl



The vomitory provides 11.2 feet of clear egress width. The vomitory can accommodate 1,221 people. This was calculated using the smoke protected exit factors Table 1028.6.2 of the 2009 MUBEC and Table 12.4.2.3 of the 2009 Edition NFPA 101 for an occupancy with 8,700 occupants (interpolated to 0.11 inches per occupant).

$$W_{Vomitory} = \left(0.11\ \frac{inches}{occupant} \times \frac{1\ foot}{12\ inches} \times \frac{Vomitory\ width}{11.2\ feet}\right)^{-1} = 1{,}221\ occupants$$

4. System Activation and Alarm Notification

The occupants of the Seating Bowl can see the Event Level floor so notification of a fire event was assumed to be by observation from the Seating Bowl occupants and not by alarm.

5. Egress Initiation

For a fire in the Seating Bowl, the time for occupants to recognize there was a fire and start to move is estimated to be 0.5 minutes. This number includes time required for both alarm pre-action and alarm recognition. This time accounts for people to realize there is an emergency and begin their egress into the Seating Bowl.

6. Timed Egress Calculations

The following section calculates the time required for the last person to exit the Seating Bowl after alarm recognition.

The time required for the last person to exit through the vomitory in the Seating Bowl is calculated by dividing the longest travel distance to the vomitory by the slow travel speed(s), in Table B.1.1 above, and comparing these times to the times required for queues to flow through the various egress elements encountered. The maximum travel distance was calculated from the center seat of the highest row of the Seating Bowl to the vomitory.

Time to travel the maximum travel distance of 72 feet (a summation of different egress conditions including seating rows and stairs with 7 inch risers) was calculated using the slow travel speed (60 feet/minute) from Table B.1.1 above. The following equations illustrate the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.1.1 above):

Travel Time at 60 Feet per Minute:

$$72\ feet \times \frac{1\ minute}{60\ feet} = 1.2\ minutes$$

The flow time through the vomitory was calculated using the flow rate through doors (21 people/feet·minute) from Table B.1.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.1.1 above):

Time to flow through the vomitory:

$$\frac{21\ people}{feet \cdot minute} \times (11.2\ foot\ wide\ vomitory\ width) = \frac{235.2\ people}{minute}$$

$$587\ people\ (population) \times \frac{1\ minute}{235.2\ people} = 2.5\ \ minutes$$

Note: The Seating Bowl population that serves this vomitory was determined to be the largest population exiting through a vomitory and is therefore the worst case scenario.

If the last slowest person arrives at the vomitory in a greater time than the vomitory flow time, no queue will exist at the vomitory; however, if the last slowest person arrives at the vomitory in less time than the vomitory flow time, they must wait until the queue subsides before they can exit the Seating Bowl.

Since the exit flow time (2.5 minutes) is greater than the travel time (1.2 minutes), the exit flow time of 2.5 minutes will be used for the total egress time calculations. The total egress time is summed up in Table B.1.2 below:

Table B.1.2
Seating Bowl Total Egress Time

PHASE	TIME
Fire Alarm activation (beam smoke detector)	N/A [1]
Time to initiate egress	0.5 minutes
Vomitory flow from Seating Bowl (greater than travel time)	2.5 minutes
Seating Bowl Total Egress Time:	**3.0 minutes**
Total Egress Time with 2009 MUBEC Safety Factor (1.5):	**4.5 minutes**

[1] *See Item 4 above. The occupants of the Seating Bowl can see the Event Level floor so notification of a fire event was assumed to be by observation from the Seating Bowl occupants and not by alarm.*

The visibility for all occupants to exit the Seating Bowl is sufficient before the visibility recorded at data points 1E and 2E (six feet above the highest seats in the Seating Bowl) drops below 30 feet as referenced by Appendix A of this report (the tenability limit for visibility based on data from studies referenced in the Society of Fire Protection Engineers Handbook).

Since the total egress time multiplied by the 1.5 safety factor (4.5 minutes) is less than the time it takes for the visibility at data points 1E and 2E (six feet above the highest seats in the Seating Bowl) to drop below 30 feet (9.1 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six (6) feet above the highest seats in the Seating Bowl in accordance with Section 909.8 of the 2009 MUBEC.

B.2 TIMED EGRESS ANALYSIS – DESIGN FIRE 4 [MAIN CONCOURSE LEVEL]

A timed egress analysis is presented to demonstrate that the occupants of the Main Concourse Level of the Cumberland County Civic Center can exit from the Main Concourse before the visibility recorded at data points 4A, 4C, 4D, and 4E (six feet above the south Main Concourse) drops below 30 feet as referenced by Appendix A of this report (the tenability limit for visibility based on data from studies referenced in the Society of Fire Protection Engineers Handbook). This specific scenario is based upon Design Fire 4 Scenario that models a fire on the Mechanical Level below the southeast corner of the Main Concourse. Below are the calculations for the total required egress time:

1. Methodology

The exit rate calculations used in this analysis are similar to the flow rates found in Dr. John Fruin's work, Pedestrian Planning and Design as a Level of Service "E" referenced in Chapter 14, Section 3 of the Society of Fire Protection Engineers (SFPE) Handbook of Fire Protection Engineering, 3rd Edition. The flow rates and travel speeds used in this study are conservative and are consistent with emergency exiting considerations. During non-emergency conditions, many persons exit at their leisure and exit times longer than those reported in this study are expected. Studies indicate the human behavior known as panic is rare and does not occur if adequate exits are provided.

The flow rate used for persons traveling through doors or on level accessways is on the lower end of the range provided by Fruin.

The following flow rates and travel speeds have been used:

Table B.2.1
Travel Speeds and Flow Rates

ELEMENT	TRAVEL SPEED IN FEET/MINUTE (ft/m)	FLOW RATE IN PEOPLE/FEET/MINUTE (pfm)
Stairs & stepped aisles (7 inch risers)	60.0 (slow); 100.0 (fast)*	17.0
Stairs & stepped aisles (8 inch risers)	35.0 (slow); 80.0 (fast)*	15.3
Doors	-----	21.0
Seating Rows	35.0 (slow); 80.0 (fast)*	-----
Level exit components	150 (slow); 200 (fast) *	21.0

* The faster speed is used to consider the time for the first person to reach an exit (i.e., the lead person in a crowd). The slower speed is used to address the movement expected by the elderly, persons with disabilities and the last person in a crowd.

2. Definitions

The following terms are defined to provide clarity:

Queue (Queuing) - Pedestrian waiting condition where forward movement essentially stops and people become stationary for a period of time.

Flow Time - This is the amount of time for a population to pass a particular point.

Egress Time - This is the total time for a population to traverse across a space and includes both the flow time through a point and the travel time to an exit element.

3. Population

The exit analysis uses the populations calculated according to Chapter 10 of the 2009 MUBEC for the total occupants of the southeast corner of the Main Concourse. The total population of the southeast corner of the Main Concourse is 278 people (see Figure B.2.1 below). This population was determined by dividing the floor area of the southeast corner of the Main Concourse by the concentrated floor area allowance per occupant from Table 1004.1.1 of the 2009 MUBEC. The floor area of the southeast corner of the Main Concourse was calculated at 1,940 square feet. Since the southeast corner of the Main Concourse is to function as an assembly space (concession area) with tables and chairs, the floor area allowance per occupant chosen was 7 square feet per person (net) for concentrated use. This floor area per occupant value is consistent with those provided in Table 7.3.1.2 of the 2009 NFPA 101. Dividing the floor area by the square feet per person yields a maximum occupant load of 278 people.

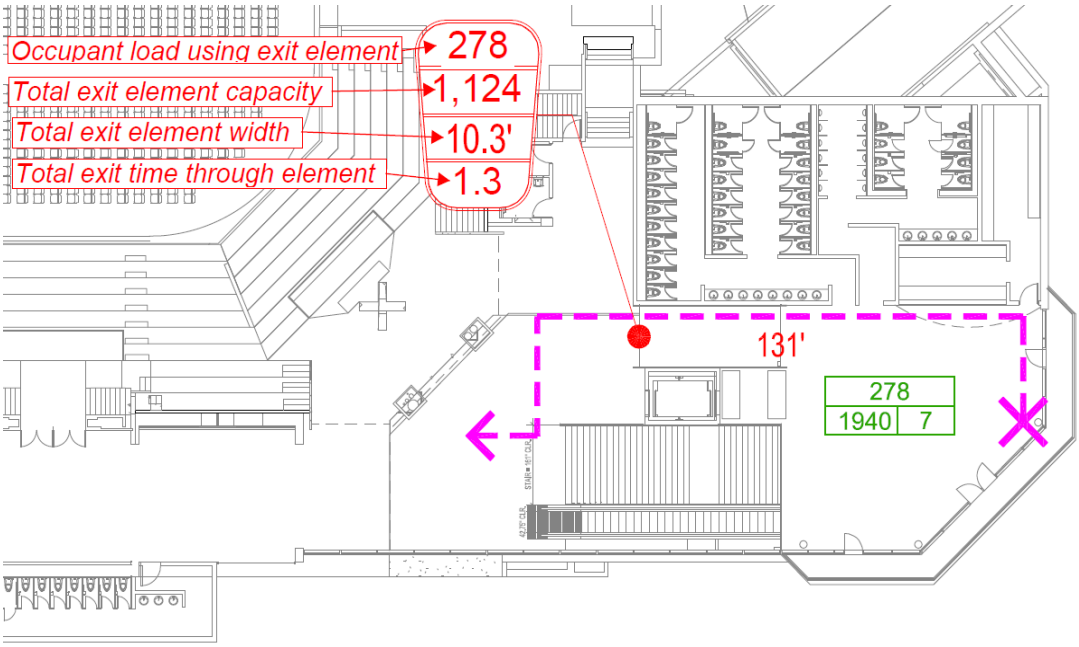
$$O_{Main\ Concourse} = 1{,}940\ sqft \times \frac{1\ occupant}{7\ sqft} = 278\ occupants$$

The southeast corner of the Main Concourse opens directly into the south end of the Main Concourse by a ramp that is 10.3 feet wide.

The ramp can accommodate 1,124 people. This was calculated using the smoke protected exit factors Table 1028.6.2 of the 2009 MUBEC and Table 12.4.2.3 of the 2009 NFPA 101 for an occupancy with 8,700 occupants (interpolated to 0.11 inches per occupant).

$$W_{Ramp} = \left(0.11\ \frac{inches}{occupant} \times \frac{1\ foot}{12\ inches} \times \frac{Ramp\ width}{10.3\ feet}\right)^{-1} = 1{,}124\ occupants$$

Figure B.2.1
Travel Distances in the Southeast Corner of the Main Concourse



Populations for the exiting from the Seating Bowl were calculated from the Seating Bowl seating section manifests. See Figure B.2.2 through B.2.5 below for the travel distances and flow calculations used in this analysis.

Figure B.2.2
Travel Distances in the South Main Concourse from the Vomitories

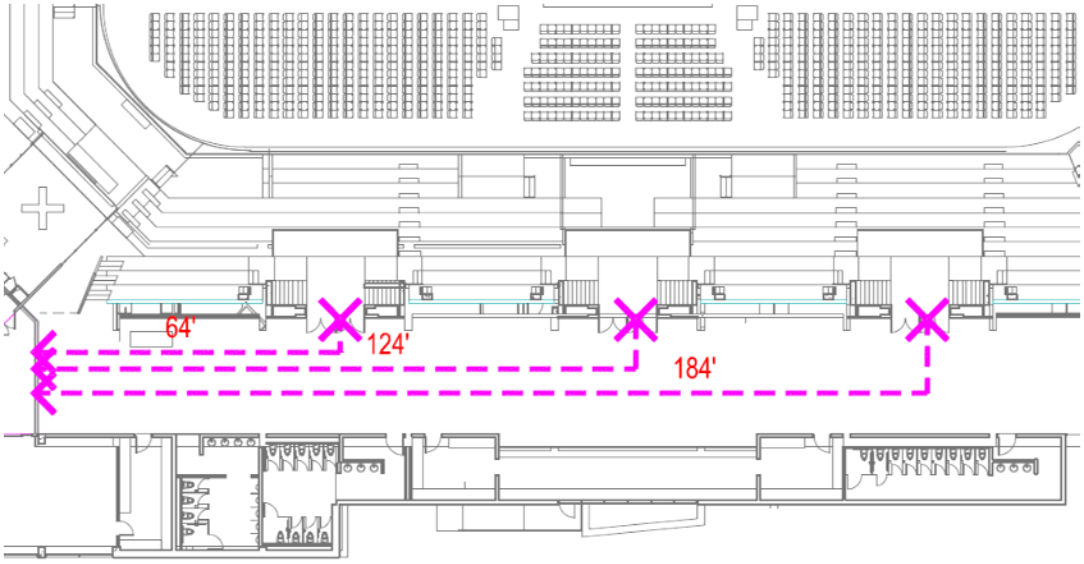


Figure B.2.3
Travel Distances and Flow Times in the Seating Bowl for the East Vomitory

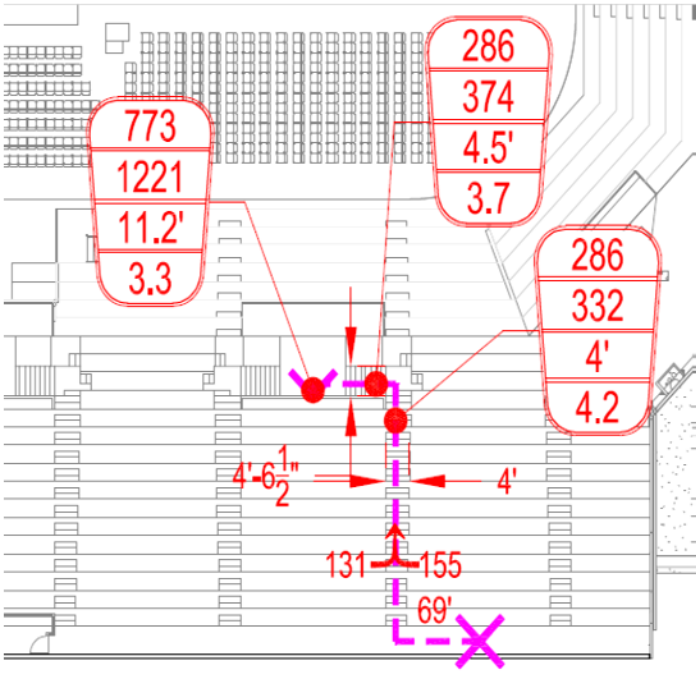


Figure B.2.4
Travel Distances and Flow Times in the Seating Bowl for the Central Vomitory

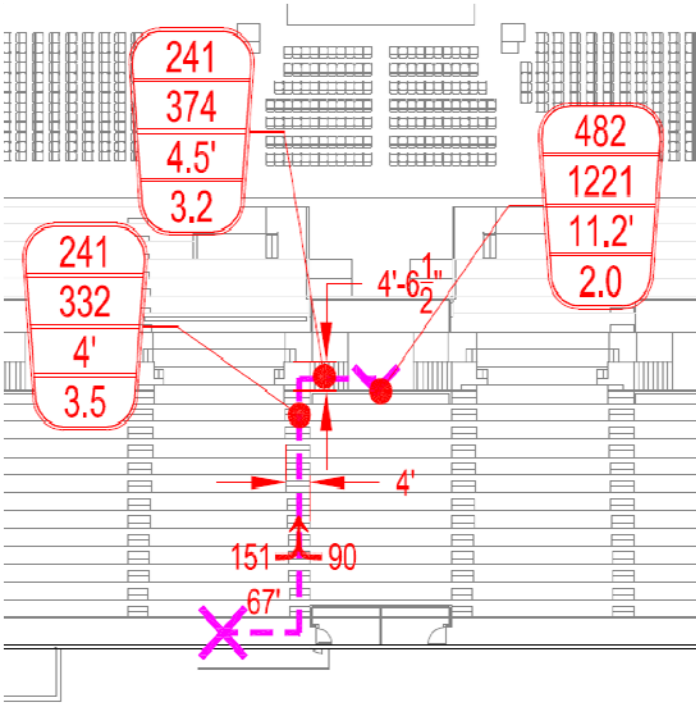
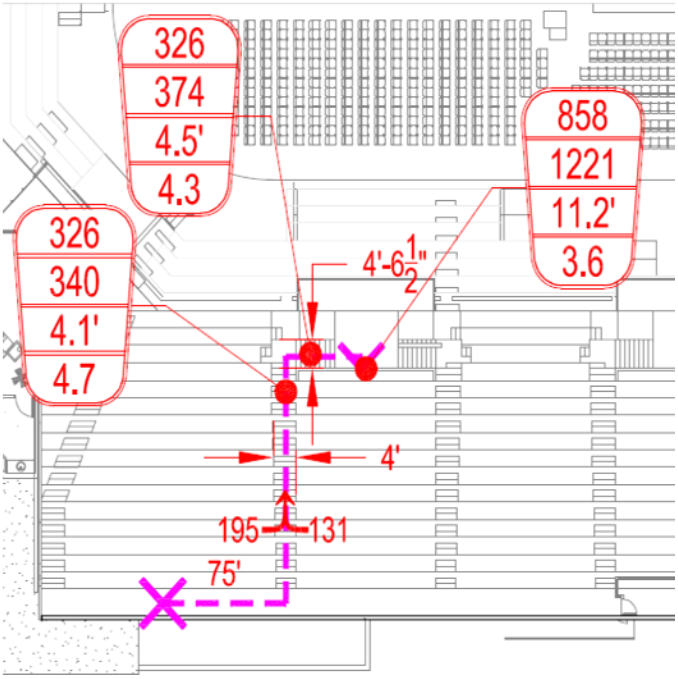


Figure B.2.5
Travel Distances and Flow Times in the Seating Bowl for the West Vomitory



4. System Activation and Alarm Notification

The time required for the building systems to detect a fire on the Mechanical Level was determined based upon the simulation results from the FDS software. The worst case scenario modeled area smoke detector activation at 38.4 seconds. By adding 10 seconds for transmission time of the detector activation to the alarm panel a total time of 48.4 seconds or 0.8 minutes was estimated for system activation and alarm notification.

5. Egress Initiation

For a fire at the Mechanical Level Lobby, the time for occupants of the Seating Bowl and the southeast corner of the Main Concourse to recognize there was a fire and start to move is estimated to be 0.5 minutes. This number includes time required for both alarm pre-action and alarm recognition.

6. Timed Egress Calculations

The following section calculates the time required for the last person to exit the southeast corner of the Main Concourse and for the last person to exit from the Seating Bowl through the south vomitories after alarm recognition.

6.1 The time required for the last person to exit from southeast corner of the Main Concourse is calculated by dividing the longest travel distance to the exit discharge door by the slow travel speed(s), in Table B.2.1 above, and comparing these times to the times required for queues to flow through the various egress elements encountered. The maximum travel distance was calculated from the farthest end of the southeast corner of the Main Concourse to the stairs that egress to the Mechanical Level.

Time to travel the maximum travel distance of 125 feet was calculated using the slowest travel speed (150 feet/minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.1 above):

Travel Time at 150 Feet per Minute:

$$131\ feet\ \times \frac{1\ minute}{150\ feet} = 0.9\ minutes$$

The flow time through the ramp was calculated using the flow rate through a level exit component (21 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.1 above):

Time to flow through the ramp:

$$\frac{21\ people}{feet \cdot minute} \times (10.3\ foot\ wide\ door\ width) = \frac{216.3\ people}{minute}$$

$$278\ people\ (population) \times \frac{1\ minute}{216.3\ people} = 1.3\ \ minutes$$

If the last slowest person arrives at the ramp in a greater time than the ramp flow time, no queue will exist at the ramp; however, if the last slowest person arrives at the ramp in less time than the ramp flow time, they must wait until the queue subsides before they can exit the southeast corner of the Main Concourse.

Since the largest exit flow time (1.3 minutes) is greater than the greatest travel time (0.9 minutes), the exit flow time of 1.3 minutes will be used for the total egress time calculations with respect to Data Point 4A (the data point of concern on the southeast). The total egress time is summed up in Table B.2.2 below:

Table B.2.2
Southeast Corner of Main Concourse Total Egress Time

PHASE	TIME
Fire Alarm activation (spot smoke detector)	0.8 minutes
Time to initiate egress	0.5 minutes
Ramp flow from southeast corner of the Main Concourse (greater than travel time)	1.3 minutes
Southeast Corner of the Main Concourse Total Egress Time:	**2.6 minutes**
Total Egress Time with 2009 MUBEC Safety Factor (1.5):	**3.9 minutes**

The visibility for all occupants to exit the southeast corner of the Main Concourse is sufficient before the visibility on the Main Concourse in the vicinity of Data Point 4A drops below 30 feet as referenced by Appendix A of this report (the tenability limit for visibility based on data from studies referenced in the Society of Fire Protection Engineers Handbook).

Since the total egress time multiplied by the 1.5 safety factor (3.9 minutes) is less than the time it takes for the visibility at the southeast corner of the Main Concourse in the vicinity of Data Point 4A to drop below 30 feet (4.6 minutes), sufficient time is allowed for all occupants to exit with tenable conditions six (6) feet above the Main Concourse in accordance with Section 909.8 of the 2009 MUBEC.

6.2 The time required for the last person to exit from Seating Bowl through the vomitories to the Main Concourse was calculated by dividing the longest travel distance to the vomitories by the slow travel speed(s), in Table B.2.1 above, and comparing these times to the times required for queues to flow through the various egress elements encountered. The maximum travel distance was calculated from the farthest seat from each vomitory used for egress from the Seating Bowl.

6.2.1 East Vomitory

6.2.1.1 Travel Distance

Two separate travel distances were analyzed to determine the maximum travel time anticipated for egress from the Seating Bowl and out of the south Main Concourse.

1. Time to travel the maximum travel distance in the Seating Bowl of 69 feet (a summation of different egress conditions including seating rows and stairs with 7 inch risers) was calculated using the slow travel speed (60 feet/minute) from Table B.2.1 above. The following equation illustrates the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.3 above):

   Travel Time at 60 Feet per Minute:

$$69\ feet\ \times \frac{1\ minute}{60\ feet} = 1.2\ minutes$$

2. Time to travel the maximum travel distance on the Main Concourse of 184 feet was calculated using the slow travel speed (150 feet/minute) from Table B.2.1 above. The following equation illustrates the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.2 above):

   Travel Time at 150 Feet per Minute:

$$184\ feet\ \times \frac{1\ minute}{150\ feet} = 1.2\ minutes$$

   The resulting greatest travel time was 1.2 minutes (equal between the two travel distances measured).

6.2.1.2 Flow Time

Three separate flow times were analyzed to determine the maximum flow time anticipated for egress from the Seating Bowl and out of the south Main Concourse. Seating Bowl populations were based on fixed seat counts for the Upper Bowl.

1. The flow time down the narrow stair aisle from the highest seat was calculated using the flow rate through an exit component with assumed 7-inch risers (17 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.3 above):

Time to flow through the narrow stair aisle (4’ 0” wide):

$$\frac{17\ people}{feet \cdot minute} \times (4\ foot\ width) = \frac{68\ people}{minute}$$

$$286\ people\ \left(\frac{population}{Upper\ Bowl}\right) \times \frac{1\ minute}{68\ people} = 4.2\ \ minutes$$

2. The flow time down the wide stair aisle that leads to the vomitory was calculated using the flow rate through an exit component with assumed 7-inch risers (17 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.3 above):

   Time to flow through the wide stair aisle (4’ 6” wide):

$$\frac{17\ people}{feet \cdot minute} \times (4.5\ foot\ width) = \frac{76.5\ people}{minute}$$

$$286\ people\ \left(\frac{population}{Upper\ Bowl}\right) \times \frac{1\ minute}{76.5\ people} = 3.7\ \ minutes$$

3. The flow time through the vomitory was calculated using the flow rate through a level exit component (21 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.3 above):

   Time to flow through the vomitory (11' 2" wide):

$$\frac{21\ people}{feet \cdot minute} \times (11.2\ foot\ width) = \frac{235.2\ people}{minute}$$

$$773\ people\ \left(\frac{population}{Upper\ /\ Lower\ Bowl}\right) \times \frac{1\ minute}{235.2\ people} = 3.3\ \ minutes$$

   The resulting greatest flow time was 4.2 minutes (from the Upper Seating Bowl through the narrow stair aisle).

6.2.2 Central Vomitory

6.2.2.1 Travel Distance

Two separate travel distances were analyzed to determine the maximum travel time anticipated for egress from the Seating Bowl and out of the south Main Concourse.

1. Time to travel the maximum travel distance in the Seating Bowl of 67 feet (a summation of different egress conditions including seating rows and stairs with 7 inch risers) was calculated using the slow travel speed (60 feet/minute) from Table B.2.1 above. The following equation illustrates the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.4 above):

   Travel Time at 60 Feet per Minute:

$$67\ feet\ \times \frac{1\ minute}{60\ feet} = 1.1\ minutes$$

2. Time to travel the maximum travel distance on the Main Concourse of 124 feet was calculated using the slow travel speed (150 feet/minute) from Table B.2.1 above. The following equation illustrates the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.2 above):

   Travel Time at 150 Feet per Minute:

$$124\ feet \times \frac{1\ minute}{150\ feet} = 0.8\ minutes$$

The resulting greatest travel time was 1.1 minutes (from the Upper Seating Bowl).

6.2.2.2 Flow Time

Three separate flow times were analyzed to determine the maximum flow time anticipated for egress from the Seating Bowl and out of the south Main Concourse. Seating Bowl populations were based on fixed seat counts for the Upper Bowl.

1. The flow time down the narrow stair aisle from the highest seat was calculated using the flow rate through an exit component with assumed 7-inch risers (17 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.4 above):

   Time to flow through the narrow stair aisle (4' 0" wide):

$$\frac{17\ people}{feet \cdot minute} \times (4\ foot\ width) = \frac{68\ people}{minute}$$

$$241\ people\ \left(\frac{population}{Upper\ Bowl}\right) \times \frac{1\ minute}{68\ people} = 3.5\ \ minutes$$

2. The flow time down the wide stair aisle that leads to the vomitory was calculated using the flow rate through an exit component with assumed 7-inch risers (17 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.4 above):

   Time to flow through the wide stair aisle (4' 6" wide):

$$\frac{17\ people}{feet \cdot minute} \times (4.5\ foot\ width) = \frac{76.5\ people}{minute}$$

$$241\ people\ \left(\frac{population}{Upper\ Bowl}\right) \times \frac{1\ minute}{76.5\ people} = 3.2\ \ minutes$$

3. The flow time through the vomitory was calculated using the flow rate through a level exit component (21 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.4 above):

   Time to flow through the vomitory (11' 2" wide):

$$\frac{21\ people}{feet \cdot minute} \times (11.2\ foot\ width) = \frac{235.2\ people}{minute}$$

$$482\ people\ \left(\frac{population}{Upper\ /\ Lower\ Bowl}\right) \times \frac{1\ minute}{235.2\ people} = 2.0\ \ minutes$$

The resulting greatest flow time was 3.5 minutes (from the Upper Seating Bowl through the narrow stair aisle).

6.2.3 West Vomitory

6.2.3.1 Travel Distance

Two separate travel distances were analyzed to determine the maximum travel time anticipated for egress from the Seating Bowl and out of the south Main Concourse.

1. Time to travel the maximum travel distance in the Seating Bowl of 75 feet (a summation of different egress conditions including seating rows and stairs with 7 inch risers) was calculated using the slow travel speed (60 feet/minute) from Table B.2.1 above. The following equation illustrates the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.5 above):

   Travel Time at 60 Feet per Minute:

$$75\ feet\ \times \frac{1\ minute}{60\ feet} = 1.3\ minutes$$

2. Time to travel the maximum travel distance on the Main Concourse of 64 feet was calculated using the slow travel speed (150 feet/minute) from Table B.2.1 above. The following equation illustrates the methodology for determining the total required egress time based on travel distance (based on the calculated travel distance shown in Figure B.2.2 above):

   Travel Time at 150 Feet per Minute:

$$64\ feet\ \times \frac{1\ minute}{150\ feet} = 0.4\ minutes$$

The resulting greatest travel time was 1.3 minutes (from the Upper Seating Bowl).

6.2.3.2 Flow Time

Three separate flow times were analyzed to determine the maximum flow time anticipated for egress from the Seating Bowl and out of the south Main Concourse. Seating Bowl populations were based on fixed seat counts for the Upper Bowl.

1. The flow time down the narrow stair aisle from the highest seat was calculated using the flow rate through an exit component with assumed 7-inch risers (17 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.5 above):

   Time to flow through the narrow stair aisle (4' 1" wide):

$$\frac{17\ people}{feet \cdot minute} \times (4.1\ foot\ width) = \frac{69.7\ people}{minute}$$

$$326\ people\ \left(\frac{population}{Upper\ Bowl}\right) \times \frac{1\ minute}{69.7\ people} = 4.7\ \ minutes$$

2. The flow time down the wide stair aisle that leads to the vomitory was calculated using the flow rate through an exit component with assumed 7-inch risers (17 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.5 above):

   Time to flow through the wide stair aisle (4' 6" wide):

$$\frac{17\ people}{feet \cdot minute} \times (4.5\ foot\ width) = \frac{76.5\ people}{minute}$$

$$326\ people\ \left(\frac{population}{Upper\ Bowl}\right) \times \frac{1\ minute}{76.5\ people} = 4.3\ \ minutes$$

3. The flow time through the vomitory was calculated using the flow rate through a level exit component (21 people/feet·minute) from Table B.2.1 above. The following equations illustrate the methodology for determining the total required flow time (based on the calculated flow width and population shown in Figure B.2.5 above):

   Time to flow through the vomitory (11' 2" wide):

$$\frac{21\ people}{feet \cdot minute} \times (11.2\ foot\ width) = \frac{235.2\ people}{minute}$$

$$858\ people\ \left(\frac{population}{Upper\ /\ Lower\ Bowl}\right) \times \frac{1\ minute}{235.2\ people} = 3.6\ \ minutes$$

   The resulting greatest flow time was 4.7 minutes (from the Upper Seating Bowl through the narrow stair aisle).Since the largest exit flow time for the East, Central and West Seating Bowl/vomitory scenarios (4.2 minutes, 3.5 minutes, and 4.7 minutes, respectively) is greater than the greatest travel time for the East, Central and West Seating Bowl/vomitory scenarios (1.2 minutes, 1.1 minutes, and 1.3 minutes,

respectively), the exit flow times for each scenario will be used for the total egress time calculations with respect to each of the data points of concern. The total egress time is summed up in Table B.2.3 below:

Table B.2.3
South Main Concourse Total Egress Time

PHASE	TIME		
Fire Alarm activation (spot smoke detector)	0.8 minutes		
Time to initiate egress	0.5 minutes		
Narrow stair aisle flow from Upper Seating Bowl (greater than travel time)	4.2 minutes	3.5 minutes	4.7 minutes
South Main Concourse Total Egress Time:	**5.5 minutes**	**4.8 minutes**	**6.0 minutes**
Total Egress Time with 2009 MUBEC Safety Factor (1.5):	**8.3 minutes**	**7.2 minutes**	**9.0 minutes**

The visibility for all occupants to exit the south Main Concourse is sufficient before the visibility on the Main Concourse in the vicinity of Data Points 4C, 4D, and 4E drops below 30 feet as referenced by Appendix A of this report (the tenability limit for visibility based on data from studies referenced in the Society of Fire Protection Engineers Handbook).

Since the total egress time multiplied by the 1.5 safety factor for East, Central, and West vomitories (8.3 minutes, 7.2 minutes, and 9.0 minutes, respectively) is less than the time it takes for the visibility on the south Main Concourse in the vicinity of Data Points 4C, 4D, and 4E to drop below 30 feet (9.7 minutes, 14.5 minutes, and 18.1 minutes, respectively), sufficient time is allowed for all occupants to exit with tenable conditions six (6) feet above the Main Concourse in accordance with Section 909.8 of the 2009 MUBEC.