PROJECT MANUAL FOR:

CRESCENT HEIGHTS APARTMENT SUITES

Portland, Maine

Owner

Crescent Heights, LLC

April 2, 2009

Winton Scott Architects
5 Milk Street
Portland, Maine

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NOTICE TO CONTRACTORS

Sealed Proposals, in envelopes plainly marked, Proposal For:

CRESCENT HEIGHTS

Brief Job Description:

The Work involves the construction of the new Crescent Heights facility at location indicated on Drawings. Work includes, but is not limited to, selective site demolition, earthwork, site utilities and site improvements, paving, and landscaping. Work also includes concrete foundations and slab-on-grade, wood structure, wood trusses and decking, membrane roofing, sheet metal, masonry veneer, wood and metal stud partitions, insulation, gypsum board walls and ceilings, resilient flooring, carpeting, custom cabinets and fixtures, carpentry, painting, metal doors, wood doors, metal frames, door hardware, metal fabrications, toilet accessories, signage, fire alarm systems, security systems, electrical, and heating, ventilating, and air conditioning complete and ready for use.

Addressed to: Mr. **Kevin Bunker**
Developers Collaborative
17 Chestnut St.
Portland, ME 04101

Proposals will be received at the office of the **Developers Collaborative** located at **17 Chestnut Street, 2nd floor conference room**, at or before **2:00 P.M**. then prevailing time on **Tuesday**, **May 5, 2008**.

The Owner reserves the right to waive all formalities, and reject any and all Proposals or to accept any Proposal. Proposals shall be submitted upon the Form provided with the Specifications.

The Selected General Contractor will be required to furnish a 100% Contract Performance Bond and a 100% Contract Payment Bond to cover the execution of the Work which shall be in conformity with the Form of Bonds listed in the Table of Contents of the specifications and for the Contract Amount.

The Notice to Proceed is anticipated to be issued on or about **May 15, 2009**. This project shall be substantially complete on June 1, 2010.

Plans and specifications may be obtained on or about **April 6, 2009**. The procedure for obtaining documents is as follows:

The complete Bidding Documents, consisting of Instructions to Bidders, Bid Forms, General Conditions, Supplemental General Conditions, Contract Forms, Drawings, Specifications, and Addenda (if any), may be obtained from:

FMC Cadd
75 Bishop Street
Portland, ME 04103
Tel: 878-8511
Fax: 878-8515
Attn. Ruth Daigle

Bidders may purchase Bid Document Full Sets ONLY for $200.00 (non refundable), which will cover complete set of drawings, specifications, any addenda and any necessary shipping and handling. The

payment shall be by check or money order payable to **FMC Cadd**. Bidders picking up documents are advised to verify their availability beforehand.

Documents remain the property of the Architect and shall be returned on demand. Federal copyright law protects documents. Reproduction of documents without written authorization from the Architect or use of such documents for the preparation of bids subjects the bidder to having their bids disqualified.

PROJECT ARCHITECT: The Architect for this project and contact information is as follows:

Winton Scott Architects, PA
5 Milk Street
Portland, ME 04101

Project Manager: Mark Wilcox

T. (207) 774-4811 extension 2#
F. (207) 774-3083
E. mwilcox@wintonscott.com

PRE-BID CONFERENCE:

A General Contractor mandatory pre-bid conference will be held **at 10:00 AM on Monday, April 13, 2009, at Developers Collaborative, Second Floor Conference Room, 17 Chestnut Street, Portland, Maine.** A walk of the site will follow the meeting. The purpose of the conference will be to answer questions of prospective Bidders, and provide a walk through of the construction site area.
Other interested subcontractors or suppliers are invited to attend.

INVITED BIDDERS: The following General Contractors have been invited to submit bids for this project:

1. **Benchmark**
   34 Thomas Drive
   Westbrook, ME 04092
   Ph: 207-591-7600
   F: 207-591-7604
   Attn: Kevin Rilley

2. **H.L. Patten Construction**
   P.O. Box 4050
   Kittery, ME 03904
   Ph: 207-439-2008
   F: 207-439-2068
   Attn: Brett Patten

3. **Hebert Construction Corporation**
   9 Gould Road
   Lewiston, Maine 04240
   Ph: 207-783-2091
   F: 207-782-4398
   Attn: Daniel Hebert / Mark Hebert

4. **Pizzagalli Construction**
   131 Presumpscot St.
   Portland, ME 04103
   Ph: 207-874-2323
   F: 207-874-2727
   Attn: Kevin Freeman

5. **Portland Builders**
85 York St. #3
Portland, ME 04101
Ph: 207-879-0118
F: 207-772-8182
Attn: Josh Cushman

6. **Wright-Ryan Construction**
10 Danforth St.
Portland, ME 04101
Ph: 207-773-3625
F: 207-773-5173
Attn: Richard Bergeron

*Plans and Specifications may be examined at:

FMC Planroom
75 Bishop Street
Portland, ME 04103

Dodge Corporation
224 Gorham Road
Scarborough, ME 04074

Associated Constructors of Maine, Inc.
Whitten Road – P.O. Box 5519
Augusta, ME 04332-5519

Dunlap Construction Service Bureau
The Dunlap Agency
31 Court Street, P O Box 40
Auburn, ME 04210

By: Developers Collaborative

17 Chestnut Street
Portland, ME 04101

END OF SECTION

BID FORM

GENERAL CONSTRUCTION CONTRACT

PROJECT IDENTIFICATION: CRESCENT HEIGHTS, APARTMENT SUITES

BID TO: Crescent Heights, LLC

BID FROM: _____(name)
_____(address)
_____.

1. The undersigned BIDDER agrees, if this Bid is accepted, to enter into an agreement with OWNER, in the form included in the Bidding Documents, to perform and furnish the Work as specified or indicated in the Bidding Documents for the Bid Price and within the Bid Times indicated in the Bid and in accordance with the other terms and conditions of the Contract Documents.

2. In submitting this Bid, BIDDER represents, as more fully set forth in the Agreement, that:
   a. This Bid will remain subject to acceptance for 30 days after the day of Bid opening. Alternates will remain subject to acceptance for 180 days after the day of Bid opening.
   b. The Owner has the right to reject this Bid.
   c. BIDDER accepts the provisions of the Instructions and Supplementary Instructions to Bidders regarding disposition of Bid Security.
   d. BIDDER will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of OWNER'S Notice of Award.
   e. BIDDER has examined copies of the Bidding Documents.
   f. BIDDER has visited the site and become familiar with the general, local and site conditions.
   g. BIDDER is familiar with federal, state, and local laws and regulations.
   h. BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Bidding Documents and additional examination, investigations, explorations, tests, studies and data with the Bidding Documents.
   i. This Bid is genuine and not made in the interest of or on behalf of an undisclosed person, firm or corporation and is not submitted in conformity with an agreements or rules of a group, association, organization or corporations; BIDDER has not directly or indirectly induced or solicited another Bidder to submit a false or sham Bid; BIDDER has not solicited or induced a person, firm or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself an advantage over another BIDDER or over OWNER.

3. BIDDER has received addenda_____through _____.

4. BIDDER will complete the Work in accordance with the Contract Documents for the following price:

LUMP-SUM PRICE_____($_____)

The above amount includes the Allowances listed in Division 01 Section “Allowances”.

ALTERNATES:

Alternate No. 1:	White Roofing	($_____)(add) (deduct)
Alternate No. 2:	Deck Canopies	($_____)(add) (deduct)
Alternate No. 3:	Exterior Wall Insulation	($_____)(add) (deduct)
Alternate No. 4:	Window Shades	($_____)(add) (deduct)
Alternate No. 5:	Understory Fence	($_____)(add) (deduct)

UNIT PRICES: If the required quantities of the items listed below are increased or decreased by Change Order, the adjustment unit prices set forth below shall apply to such increased or decreased quantities.

1. Excavation and Removal
   Per Cu. yard of excavated material. $ _____

2. Excavation and Backfill (open)
   Per Cu. yard of excavated material. $ _____

3. Excavation and Backfill (trench)
   Per Cu. yard of excavated material. $ _____

4. Rock Excavation and Removal (open)
   Per Cu. yard of excavated material. $ _____

5. Rock Excavation and Removal (trench)
   Per Cu. yard of excavated material. $ _____

6. Granular Borrow Fill
   Per Cu. yard of material. $ _____

7. Gravel Base
   Per Cu. yard of material. $ _____

8. Gravel Subbase
   Per Cu. yard of material. $ _____

9. Bituminous Pavement – Grade B
   Per 1 inch thick sq. yd. $ _____

10. Bituminous Pavement – Grade C
    Per 1 inch thick sq. yd. $ _____

5. This proposal includes the following addenda to the plans and specifications:

Addenda No. _____. Addenda No. _____.
Addenda No. _____. Addenda No. _____.
Addenda No. _____. Addenda No. _____.

6. BIDDER agrees that the Work will be substantially complete and ready for final payment in accordance with the General Conditions on or before the following date:

June 1, 2010

7. BIDDER agrees to the following schedule of liquidated damages and bonus for early completion:

Completion Before June 1, 2010:	$150 per calendar day bonus
Completion Between June 2 and June 15 Inclusive:	$300 per calendar day liquidated damages
Completion After June 15, 2010:	$3,750 per calendar day liquidated damages

SUBMITTED on _____, 20_____.

By_____(SEAL)
(Firm Name)

_____.
(Name of Person Authorized to Sign)

Business Address:_____.

_____.

Phone No.:_____.

LIST OF SUBCONTRACTORS

Trade	Subcontractors Company Name
Sitework	_____
Concrete	_____
Masonry	_____
Steel	_____
Rough Carpentry	_____
Finish Carpentry	_____
Siding	_____
Roofing	_____
Door, Frames And Hardware	_____
Glass & Glazing	_____
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1.1 INFORMATION FOR BIDDERS

A. The information being provided for review is for the bidder's convenience and does not relieve the bidders from doing their own investigation to determine the accuracy of the information.

1.2 GEOTECHNICAL DATA

A. Description:
   1. A summary of subsurface conditions based on test borings is available for review.
   2. This report is included in Section 023200 for the Contractor's convenience.

B. Use of Data:
   1. This summary was obtained for the Architect's/Engineer's use in design and is not a part of the Contract Documents. The report is made available for Bidder's information, but is not a warranty of subsurface conditions.
   2. Bidders should visit the site and acquaint themselves with existing conditions. Prior to bidding, Bidders may make their own subsurface explorations to satisfy themselves as to site and subsurface conditions, but such investigations shall be performed only under time schedules and arrangements approved in advance by the Architect/Engineer.
   3. Neither the Architect/Engineer nor the Owner can guarantee the continuity of subsurface conditions between test locations, nor the accuracy of the report.
   4. It is expressly understood that neither the Architect/Engineer nor the Owner will be responsible for any deduction, interpretation, or conclusion made by the Contractor.
   5. No claim for extra cost or extension of time resulting from the Contractor's deductions or interpretation of soil test information shall be allowed.

END OF SECTION

SECTION 010100

SPECIAL ENVIRONMENTAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This project is being designed to include the requirements of the ”LEED For Homes – Mid-rise Multi-family Building” program. This is a comprehensive program for the design, specification, construction and operation of environmentally responsible buildings. The current scoring rating based on the design shown in the contract documents is attached as an Appendix “A” to this section. It is the intent of all sections of the project manual to affect the ratings indicated.

B. These specifications include green building practices and require the submission of basic documentation that identify and quantify the environmental attributes of products and materials

C. Section Includes Special Environmental Requirements: Work includes special environmental, sustainable, and “green” building practices related to energy conservation and efficiency, indoor air quality, and resource efficiency, including but not limited to the following:
   1. Special Requirements:
      a. Require practices to ensure healthy indoor air quality in final Project.
      b. Maximize use of low VOC emitting materials.
      c. Maximize use of durable products.
      d. Maximize use of products easy to maintain, repair, and that can be cleaned using non-toxic substances.
      e. Maximize use of reusable and recyclable packaging.
      f. Maximize use of products with low embodied energy (production, manufacturing, and transportation). Includes selection of regionally manufactured materials as well as regionally extracted, harvested, or recovered materials.
   2. Construction team is required to comply with sustainable building practices during construction and when considering materials for substitutions. Refer to Article 1.3 – Design Requirements.

D. Related Requirements: Refer to Specification sections for special environmental requirements for specific products.
   1. Section 017419: Construction Waste Management.
   2. Section 016000: Product Requirements.
   3. Section 014400: Construction Indoor Air Quality.

E. Pressure Testing: The envelope of the building has been designed utilizing a combination of drywall and extensive use of sealants between wood framing members to produce an effective Air Barrier System. This system in the past has produced successful results. This system is shown in contract documents for the exterior walls as well as unit separation partitions and corridor walls.
   1. Acceptable sealing of building as a whole and residential units shall be demonstrated by a Blower Door Test conducted in accordance with ANSI/ASTM 799, Standard Test

Method for Determining Air Leakage Rate by Fan Pressurization and should demonstrate less than 1.25 square inches leakage area per 100 square feet of enclosed area (i.e. Sum of wall, ceiling, and floor areas).

2. The Owner shall engage an independent testing agency to perform blower door testing on the completed building. Testing shall be done on the building as a whole. Testing shall also be done on selected interior units.
3. The Contractor shall schedule and coordinate the activities of the blower door testing. Work shall include the following but not limited to:
    a. Temporary hoods to seal off through wall fresh air vents.
    b. Scheduling and coordination.
    c. Temporary sealing of electrical outlets as directed.
4. Testing shall be done to evaluate the unit separation demising walls as well as the exterior envelope.
5. The testing agency shall locate leakage paths where they are present, and the Contractor shall effectively seal such leakage paths at no cost to the Owner.
    a. If minor sealing at the time of testing is not sufficient, the unit or envelope shall be repaired and retested at the Contractor's expense.

1.2 DEFINITIONS

A. Certificates of Chain-of-Custody: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria". Certificates shall include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body. Contractor shall give notice to all vendors and suppliers on the form attached to at the end of this section and shall require this certification with any submittal for products to be used in this project.

B. Rapidly Renewable Materials: Materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

C. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

D. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of 500 miles from the Project site.

E. Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).
    1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
    2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

1.3 DESIGN REQUIREMENTS

A. General: Owner has established with design team general environmental goals for design and for construction of Project; Contractor, subcontractors, suppliers, and manufacturers (construction team) are encouraged to participate where possible to realize Owner's environmental goals.
   1. Intent is for environmental goals to be achieved in manner that ultimately provides safe and healthy environment for building occupants with minimal impact on local, regional and global environment.
   2. Contract Documents are not intended to limit alternative means of achieving environmental goals.
      a. Suggestions from construction team for implementing goals are encouraged.
      b. Team approach is encouraged.

1.4 SUBMITTALS

A. General: Submit requirements included in other sections of the Specifications.

B. Project Materials Cost Data: Statements indicating total cost for building materials used for Project will not be required. Statements indicating cost for construction waste management will be required to identify percentage of construction waste diverted from landfills.

C. Indoor Air Quality (IAQ) Data:
   1. Cleaning and Maintenance Products: Provide data on manufacturers' recommended maintenance, cleaning, refinishing and disposal procedures for materials and products. These procedures are for final Contractor cleaning of the project prior to substantial completion and for provided materials and products as required by the specific specification sections.
   2. Limit VOC content to LEED for Homes program requirements. Contractor shall give notice to all vendors and suppliers on the form attached at the end of this section and require certification with any submittal of products to be used in the project.

1.5 LEED FOR HOMES PROGRAM DESIGN GOALS FOR THE PROJECT

A. The Owner has established environmental goals for the Project in accord with LEED for Homes – Mid-rise Multi-family Buildings. The Project Checklist of targeted areas is attached to the end of this section; refer to specific specification sections for more detailed goals. Notify Owner and Architect if conflicts arise between performance of the work and environmental goals. This specification is not intended to limit alternative means of achieving these goals. Suggestions and input from the Contractor(s) for implementing these goals are encouraged.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: To the greatest extent possible, deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which will be reclaimed by supplier or manufacturer for recycling.
   1. General: Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.

a. Minimize the use of polyurethane, polyisocyanate, polystyrene, polyethylene, and similar plastic materials such as “foam” plastics and “shrink-fit” plastics.

2. Reusable Blankets: Deliver and store materials in reusable blankets and mats reclaimed by manufacturers or suppliers for reuse where program exists or where program can be developed for such reuse.
3. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling.
4. Corrugated Cardboard and Paper: Where paper products are used, recycle as part of construction waste management recycling program, or return to material’s manufacturer for use by manufacturer or supplier.
5. Sealants, Paint, Primers, Adhesives, and Coating Containers: Return to supplier or manufacturer for reuse where such program is available.

1.7 PROJECT CONDITIONS

A. No smoking will be permitted in indoor Project site locations.

B. Construction Ventilation and Preconditioning:
1. Temporary Construction Ventilation: Maintain sufficient temporary ventilation of areas where materials are being used that emit VOCs. Maintain ventilation continuously during installation, and until emissions dissipate after installation. If continuous ventilation is not possible via building’s HVAC system(s) then ventilation shall be supplied via open windows and temporary fans, sufficient to provide no less than three air changes per hour.
a. Period after installation shall be sufficient to dissipate odors and elevated concentrations of VOCs. Where no specific period is stated in these Specifications, a time period of 72 hours shall be used.
b. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.
2. During dust producing activities (e.g. drywall installation and finishing) turn ventilation system off, and openings in supply and return HVAC system shall be protected from dust infiltration. Provide temporary ventilation as required.
3. Pathway Interruption: Prevent contamination of clean spaces. Include the following strategies that apply:
a. Use 100% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) with air exhausted directly to the outside during installation of finishes and other VOC emitting materials.
b. 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
4. Preconditioning: Prior to installation, allow products which have odors and significant VOC emissions to off-gas in dry, well-ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions prior to delivery to Project site.
a. Condition products without containers and packaging to maximize off-gassing of VOCs
b. Condition products in ventilated warehouse or other building. Comply with substitution requirements for consideration of other locations.

C. Protection:

1. Moisture Stains: Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site and properly dispose. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew on packaging and on products.
   a. Immediately remove from site and properly dispose of materials showing signs of mold and signs of mildew, including materials with moisture stains.
   b. Replace moldy materials with new, undamaged materials.
2. Ducts: Seal ducts during transportation, delivery, and construction to prevent accumulation of construction dust and construction debris inside ducts.

D. Implementation:
1. Manager: The Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing and the Construction Ventilation and Preconditioning for the Project.
2. Progress Meetings: Construction related Construction Ventilation and Preconditioning procedures shall be included in the pre-construction and construction progress meeting agendas.
3. Instruction: The Contractor shall provide on-site instruction of the Construction Ventilation and Preconditioning procedures and ensure that all participants in the construction process understand the importance of the goals of the Construction Ventilation and Preconditioning procedures.

PART 2 - PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. The cost of post-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

B. The cost of post consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

C. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).

2.2 CERTIFIED TROPICAL WOOD

A. If tropical wood is provided, provide wood-based materials that are produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Contractor shall give notice to all vendors and suppliers and shall require this certification with any submittal for products to be used in this project. Notice may follow the following language:

1. Notice to Vendors/Suppliers: (Company name here) will purchase products that contain tropical wood only if they are certified according to the guidelines of the Forest Stewardship Council (FSC - See www.fsc.org or www.fscus.org for more information). Please provide the country of manufacture for each wood product you expect to supply to us. Also, please provide a list of FSC-certified products you can supply.

2.3 LOW-EMITTING MATERIALS

A. Provide products that comply with LEED for Homes requirement on VOC content. In case of composite material, provide product that contain no added urea-formaldehyde resins. Contractor shall give notice to all vendors and suppliers and shall require this certification with any submittal for products to be used in this project. Notice may follow the following language:

1. Notice to Vendors/Suppliers: (Company name here) will not purchase laminating adhesives or composite wood board products (particleboard, plywood, OSB, MDF), or cabinets, doors, countertops or other products to be installed on the interior that are manufactured with and contain urea-formaldehyde resins. For each laminating adhesive, board product, or product containing composite materials that you expect to supply to us, please provide cut sheets or documentation from the manufacturer stating that they are urea-formaldehyde free.

B. For all interior paint applications use paint and coatings that comply with the following limits for VOC content:

Table 2. Standards for Environmentally Preferable Paints and Coatings

Component	Applicable standard (VOC content)	Reference
Architectural paints, coatings, and primers applied to interior walls and ceilings	Flats: 50 g/L Nonflats: 150 g/L	Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993
Anticorrosive and antirust paints applied to interior ferrous metal substrates	250 g/L	Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997
Clear wood finishes	Varnish: 350 g/L Lacquer: 550 g/L	South Coast Air Quality Management District Rule 1113, Architectural Coatings
Floor coatings	100 g/L	
Sealers	Waterproofing: 250 g/L Sanding: 275 g/L All others: 200 g/L	
Shellacs	Clear: 730 g/L Pigmented: 550 g/L	
Stains	250 g/L	

1. Restricted Components: Paints and coatings shall not contain any of the following:
   a. Acrolein.

b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride

2. For all adhesives and sealants use products that comply with the following limits for VOC content:

Table 3. Standards for Low-Emissions Adhesives and Sealants (meet South Coast Air Quality Management District Rule #1168)

	Applicable standard (VOC content, g/L less water)
Architectural applications	
Indoor carpet adhesives	50
Carpet pad adhesives	50
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
VCT and asphalt adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Specialty applications	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special-purpose contact adhesive	250
Structural wood member adhesive	140
Sheet-applied rubber lining operations	850
Top and trim adhesive	250
Substrate-specific applications	
Metal to metal	30
Plastic foams	50
Porous materials (except wood)	50
Wood	30
Fiberglass	80
Sealants	
Architectural	250
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
Sealant primers	
Architectural nonporous	250
Architectural porous	775
Other	750

PART 3 - EXECUTION

3.1 ENVIRONMENTAL GOALS IMPLEMENTATION

A. Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing the Environmental Goals for the Project.

B. Distribution: The Contractor shall distribute copies of the Environmental Goals to the job-Site Foreman, each Subcontractor, the Owner, and the Architect.

C. Meetings: Environmental Goals shall be discussed at the following meetings:
   1. Pre-bid meeting.
   2. Pre-construction meeting.
   3. Regular job-site meetings.

3.2 CLEANING

A. Final Cleaning Environmental Issues:
   1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces.
   2. Clean equipment and fixtures to sanitary condition.
   3. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.
   4. If ducts were not sealed during construction, and contain dust or dirt, clean ducts using HEPA vacuum immediately prior to Substantial Completion and prior to using ducts to circulate air. Oil film on sheet metal shall be removed before shipment to site. However, ducts shall be inspected to confirm that no oil film is present. Remove oil.
   5. Replace all air filters (i.e., pre and final filters) just prior to Substantial Completion.
   6. Follow all methods and procedures as described in Section 014400 – Construction Indoor Air Quality.
   7. Remove and properly dispose of recyclable materials using construction waste management program described in Section 017419 – Construction Waste Management and Disposal.

3.3 PROTECTION

A. Environmental Issues:
   1. Protect interior materials from water intrusion or penetration; where interior products not intended for wet applications are exposed to moisture, immediately remove from site and dispose of properly.
   2. Protect installed products using methods that do not support growth of molds and mildews.
      a. Immediately remove from site materials with mold and materials with mildew.

END OF SECTION

APPENDIX A

LEED for Homes Mid-rise Pilot Simplified Project Checklist

for Homes

Builder Name:	
Project Team Leader (If different):	
Home Address (Street/City/State):	*25 - 29 Crescent St, Portland, Maine*

Project Description:

Building type: *Mid-rise MF* Project type: *Custom*

# of bedrooms: *0* Floor area: *0*

Adjusted Certification Thresholds

Certified: *#NUM!* Gold: *#####*

Silver: *#NUM!* Platinum: *#####*

Project Point Total

Prelim: *84.5 - 13.5 maybe pts* Final: *22*

Certification Level

Prelim: *#NUM!* Final: *Not Certified*

Final Credit Category Total Points

ID: *0* SS: *3* EA: *17* EQ: *0*

LL: *0* WE *2* MR: *0* AE: *0*

Minimum Point Thresholds Not Met for Final Rating

date last updated :

last updated by :

					Max Pts	Project Points Preliminary Y/Pts	Maybe	No	Final Y/Pts
Innovation and Design Process (ID)			(No Minimum Points Required)		Max				
1. Integrated Project Planning		1.1	Preliminary Rating		Prereq	Y			
		1.2	Energy Expertise for MID-RISE		Prereq	Y			
		1.3	Professional Credentialed with Respect to LEED for Homes		1	0	0		0
		1.4	Design Charrette		1	1	0		0
		1.5	Building Orientation for Solar Design		1	0	0		0
		1.6	Trades Training for MID-RISE		1	1	0		0
2. Durability Management Process		2.1	Durability Planning		Prereq	Y			
		2.2	Durability Management		Prereq	Y			
		2.3	Third-Party Durability Management Verification		3	3	0		0
3.Innovative or Regional Design	na	3.1	Innovation #1 _____		1	0	1		0
	na	3.2	Innovation #2 _____		1	0	1		0
	na	3.3	Innovation #3 _____		1	0	1		0
	na	3.4	Innovation #4 _____		1	0	1		0
				Sub-Total for ID Category:	*11*	*5*	*4*		*0*
Location and Linkages (LL)			(No Minimum Points Required)	OR	Max	Y/Pts	Maybe	No	Y/Pts
1. LEED ND		1	LEED for Neighborhood Development	LL2-8	10	0	0		0
2. Site Selection	na	2	Site Selection		2	2	0		0
3. Preferred Locations		3.1	Edge Development		1	0	0		0
		3.2	Infill	LL 3.1	2	2	0		0
		3.3	Brownfield Redevelopment for MID-RISE		1	1	0		0
4. Infrastructure		4	Existing Infrastructure		1	1	0		0
5. Community Resources/ Transit		5.1	Basic Community Resources for MID-RISE		1	0	0		0
		5.2	Extensive Community Resources for MID-RISE	LL 5.1, 5.3	2	0	0		0
		5.3	Outstanding Community Resources for MID-RISE	LL 5.1, 5.2	3	3	0		0
6. Access to Open Space		6	Access to Open Space		1	1	0		0
				Sub-Total for LL Category:	*10*	*10*	*0*		*0*
Sustainable Sites (SS)			(Minimum of 5 SS Points Required)	OR	Max	Y/Pts	Maybe	No	Y/Pts
1. Site Stewardship		1.1	Erosion Controls During Construction		Prerequisite	Y			
		1.2	Minimize Disturbed Area of Site for MID-RISE		1	1	0		0
2. Landscaping	na	2.1	No Invasive Plants		Prerequisite	Y			
	na	2.2	Basic Landscape Design		1	0	0		0
	na	2.3	Limit Conventional Turf for MID-RISE	SS 2.4	2	0	0		0
	na	2.4	Drought Tolerant Plants for MID-RISE	SS 2.4	1	0	0		0
	na	2.5	Reduce Overall Irrigation Demand by at Least 20% for MID-RISE		3	3	0		3
3. Local Heat Island Effects	na	3.1	Reduce Site Heat Island Effects for MID-RISE		1	0	1		0
	na	3.2	Reduce Roof Heat Island Effects for MID-RISE		1	0	1		0
4. Surface Water Management	na	4.1	Permeable Lot for MID-RISE		2	0	1		0
		4.2	Permanent Erosion Controls		1	1	0		0
	na	4.3	Stormwater Quality Control for MID-RISE		2	0	0		0
5. Nontoxic Pest Control		5	Pest Control Alternatives		2	1	0		0
6. Compact Development		6.1	Moderate Density for MID-RISE		2	0	0		0
		6.2	High Density for MID-RISE	SS 6.1, 6.3	3	3	0		0
		6.3	Very High Density for MID-RISE	SS 6.1, 6.2	4	0	0		0
7. Alternative Transportation		7.1	Public Transit for MID-RISE		2	2	0		0
		7.2	Bicycle Storage for MID-RISE		1	1	0		0
		7.3	Parking Capacity/Low-Emitting Vehicles for MID-RISE		1	1	0		0
				Sub-Total for SS Category:	*22*	*13*	*3*		*3*

LEED for Homes Mid-rise Pilot Simplified Project Checklist (continued)

					Max Pts	Project Points Preliminary Y/Pts	Maybe	No	Final Y/Pts
Water Efficiency (WE)			(Minimum of 3 WE Points Required)	OR	Max				
1. Water Reuse		1	Water Reuse for MID-RISE		5	0	0		0
2. Irrigation System	na	2.1	High Efficiency Irrigation System for MID-RISE	WE 2.2	2	0	0		0
U.S. Green Building Council	na	2.2	Reduce Overall Irrigation Demand by at Least 45% for MID-RISE		2	2	0		2

3. Indoor Water Use		3.1	High-Efficiency Fixtures and Fittings		3	0	0		0
		3.2	Very High Efficiency Fixtures and Fittings		6	0	0		0
		3.3	Water Efficient Appliances for MID-RISE		2	2	0		0
				Sub-Total for WE Category:	*15*	*10*	*0*		*2*
Energy and Atmosphere (EA)			(Minimum of 0 EA Points Required)	OR	Max	Y/Pts	Maybe	No	Y/Pts
1. Optimize Energy Performance		1.1	Minimum Energy Performance for MID-RISE		Prereq	Y			
		1.2	Reduced Envelope Leakage for MID-RISE		Prereq	Y			
		1.3	Optimize Energy Performance for MID-RISE		34	17	2		17
7. Water Heating	na	7.1	Efficient Hot Water Distribution		2	0	0		0
		7.2	Pipe Insulation		1	1	0		0
11. Residential Refrigerant Management		11.1	Refrigerant Charge Test		Prereq	Y			
		11.2	Appropriate HVAC Refrigerants		1	1	0		0
				Sub-Total for EA Category:	*38*	*19*	*2*		*17*
Materials and Resources (MR)			(Minimum of 2 MR Points Required)	OR	Max	Y/Pts	Maybe	No	Y/Pts
1. Material-Efficient Framing		1.1	Framing Order \Waste Factor Limit		Prereq	Y			
		1.2	Detailed Framing Documents	MR 1.5	1	0	0		0
		1.3	Detailed Cut List and Lumber Order	MR 1.5	1	0	0		0
		1.4	Framing Efficiencies	MR 1.5	3	0	0		0
		1.5	Off-site Fabrication		4	4	0		0
2. Environmentally Preferable Products	na	2.1	FSC Certified Tropical Wood		Prereq	Y			
	na	2.2	Environmentally Preferable Products		8	5	3		0
3. Waste Management		3.1	Construction Waste Management Planning		Prereq	Y			
		3.2	Construction Waste Reduction		3	2.5	0.5		0
				Sub-Total for MR Category:	*16*	*11.5*	*3.5*		*0*
Indoor Environmental Quality (EQ)			(Minimum of 6 EQ Points Required)	OR	Max	Y/Pts	Maybe	No	Y/Pts
1. ENERGY STAR with IAP		1	ENERGY STAR with Indoor Air Package		13	0	0		0
2. Combustion Venting		2	Basic Combustion Venting Measures	EQ 1	Prereq	Y			
3. Moisture Control		3	Moisture Load Control	EQ 1	1	0	0		0
4. Outdoor Air Ventilation	na	4.1	Basic Outdoor Air Ventilation for MID-RISE	EQ 1	Prereq	Y			
		4.2	Enhanced Outdoor Air Ventilation for MID-RISE		2	0	0		0
		4.3	Third-Party Performance Testing for MID-RISE	EQ 1	1	1	0		0
5. Local Exhaust	na	5.1	Basic Local Exhaust	EQ 1	Prerequisite	Y			
		5.2	Enhanced Local Exhaust		1	1	0		0
		5.3	Third-Party Performance Testing		1	1	0		0
6. Distribution of Space Heating and Cooling	na	6.1	Room-by-Room Load Calculations	EQ 1	Prereq	Y			
		6.2	Return Air Flow / Room by Room Controls	EQ 1	1	0	1		0
		6.3	Third-Party Performance Test / Multiple Zones	EQ 1	2	2	0		0
7. Air Filtering		7.1	Good Filters	EQ 1	Prereq	Y			
		7.2	Better Filters	EQ 7.3	1	0	0		0
		7.3	Best Filters		2	0	0		0
8. Contaminant Control	na	8.1	Indoor Contaminant Control during Construction	EQ 1	1	1	0		0
		8.2	Indoor Contaminant Control for MID-RISE		2	1	0		0
	na	8.3	Preoccupancy Flush	EQ 1	1	1	0		0
9. Radon Protection	na	9.1	Radon-Resistant Construction in High-Risk Areas	EQ 1	Prereq	Y			
	na	9.2	Radon-Resistant Construction in Moderate-Risk Areas	EQ 1	1	0	0		0
10. Garage Pollutant Protection		10.1	No HVAC in Garage for MID-RISE	EQ 1	Prereq	Y			
		10.2	Minimize Pollutants from Garage for MID-RISE	EQ 1, 10.4	2	0	0		0
		10.3	Exhaust Fan in Garage for MID-RISE	EQ 1, 10.4	1	0	0		0
		10.4	Detached Garage or No Garage for MID-RISE	EQ 1	3	3	0		0
11. Environmental Tobacco Smoke Control		11.1	Environmental Tobacco Smoke Reduction for MID-RISE	EQ 1, 11.2	2	0	0		0
		11.2	Environmental Tobacco Smoke Prohibition for MID-RISE	EQ 1	2	2	0		0
				Sub-Total for EQ Category:	*21*	*13*	*1*		*0*
Awareness and Education (AE)			(Minimum of 0 AE Points Required)		Max	Y/Pts	Maybe	No	Y/Pts
1. Education of the Homeowner or Tenant	na	1.1	Basic Operations Training		Prereq	Y			
	na	1.2	Enhanced Training		1	1	0		0
		1.3	Public Awareness		1	1	0		0
2. Education of Building Manager	na	2	Education of Building Manager		1	1	0		0
				Sub-Total for AE Category:	*3*	*3*	*0*		*0*

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Project information.
2. Work covered by Contract Documents.
3. Work by Owner.
4. Work under separate contracts.
5. Owner-furnished products.
6. Access to site.
7. Work restrictions.
8. Specification and drawing conventions.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Crescent Heights, Apartment Suites.

1. Project Location: Portland, Maine.

B. Owner: Crescent Heights, LLC.

1. Owner's Representative: Alan Nichols, Northeast Development.

C. Architect Identification: The Contract Documents were prepared by Winton Scott Architects, P.A., 5 Milk Street, Portland, ME 04101.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work involves the construction of a new Apartment Building of approximately 19,400 square feet, at location indicated on Drawings. Work includes but is not limited, to building and

selected sitework demolition, earthwork, site utilities and site improvements, paving, and landscaping. Work also includes concrete foundations and slab-on-grade, wood structure, minor steel structure, wood trusses and decking, roof membrane over roof insulation, sheet metal, metal siding, masonry, wood stud partitions, insulation, gypsum board walls and ceilings, acoustical ceilings, resilient flooring, carpeting, custom cabinets and fixtures, carpentry, glass storefront system, painting, metal doors and frames, wood doors and frames, door hardware, toilet accessories, signage, lockers, fire alarm systems, security systems, electrical, and heating, ventilating, and air conditioning complete and ready for use.

B. Project is subject to LEED for Homes – Mid-rise Multi-family Building program requirements. Refer to Section 010100 and other sections of this Specifications for detailed requirements.

1.5 TYPE OF CONTRACT

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

B. Contract Type: AIA A101 - Standard Form of Agreement Between Owner and Contractor - Stipulated Sum.

1.6 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

1. Hazardous material abatement.
2. Structure removal.

1.7 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

B. Concurrent Work: Owner will award separate contracts for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Wireless Network System: A separate contract will be awarded for a wireless network system.
2. Laundry Equipment: A separate contract will be awarded for laundry equipment.

1.8 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner-Furnished Products:

1. Furniture.

1.9 ACCESS TO SITE

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

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

C. 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.

1.10 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
2. Coordinate any work in, or use of, Chestnut Street with Maine Medical Center.

B. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.

1. Weekend Hours: As approved by Architect and Owner.
2. Early Morning Hours: As approved by Architect and Owner.
3. Hours for Utility Shutdowns: As approved by Architect and Owner.
4. Hours for Core Drilling: As approved by Architect and Owner.
5. Provide 24 hour notice to Architect when performing work other than normal working hours.

C. 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 not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Architect not less than two days in advance of proposed disruptive operations.

2. Obtain Architect's written permission before proceeding with disruptive operations.

E. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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 48 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 UNUSED MATERIALS

A. Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, prepare unused material for storage by Owner when it is not economically practical to return the material for credit. If directed by Architect, deliver unused material to Owner's storage space. Otherwise, disposal of unused material is Contractor's responsibility.

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.

3.3 SCHEDULE OF ALLOWANCES

A. Allowances: None at this time.

END OF SECTION

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 – Excavation and Removal:

1. Description: Excavation of material and removal from site.
2. Unit of Measurement: Cu. yard of excavated material.

B. Unit Price No. 2 – Excavation and Backfill (open):

1. Description: Excavation and backfill with excavated material according to Division 2 Section "Earthwork."
2. Unit of Measurement: Cu. yard of excavated material.

C. Unit Price No. 3 – Excavation and Backfill (trench):

1. Description: Excavation and backfill with excavated material according to Division 2 Section "Earthwork."
2. Unit of Measurement: Cu. yard of excavated material.

D. Unit Price No. 4 – Rock Excavation and Removal (open):

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

E. Unit Price No. 5 – Rock Excavation and Removal (trench):

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

F. Unit Price No. 6 – Granular Borrow Fill:

1. Description: Granular borrow fill and backfill in place.
2. Unit of Measurement: Cu. yard of granular borrow material.

G. Unit Price No. 7 – Gravel Base:

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

H. Unit Price No. 8 – Gravel Subbase:

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

I. Unit Price No. 9 – Bituminous Pavement – Grade B:

1. Description: Bituminous pavement – Grade B, compacted in place.
2. Unit of Measurement: Per 1 inch thick sq. yd.

J. Unit Price No. 10 – Bituminous Pavement – Grade C:
1. Description: Bituminous pavement – Grade C, compacted in place.
2. Unit of Measurement: Per 1 inch thick sq. yd.

END OF SECTION

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 01 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 No. 1: White Roofing.

1. Base Bid: Provide black EPDM roof membrane and flashing.
2. Alternate: Provide white EPDM roof membrane and flashing.

B. Alternate No. 2: Deck Canopies

1. Base Bid: Fourth floor decks are open to the sky above.
2. Alternate: Provide aluminum framed polycarbonate canopies as shown. Include additional structural work, membrane roofing work, sealants and metal flashings, gutters and downspouts.

C. Alternate No. 3: Exterior Wall Insulation

1. Base Bid: Includes no insulation between the wall sheathing and siding.
2. Alternate: Over the wall sheathing provide 1-1/2 inch rigid insulation and 1/2 inch OSB. Include pressure treated blocking around all openings and at sill lines.

D. Alternate No. 4: Window Shades

1. Base Bid: Includes horizontal blinds at dwelling unit windows and vertical blinds at dwelling unit sliding glass doors.
2. Alternate: Delete horizontal blinds at unit windows. Add therefore heavy-duty roller shades and curtain rods. Delete vertical blinds at unit sliding glass doors. Add therefore traverse rod and hardware for heavy opaque fabric room side drapery and light filtering window side drapery with valance hardware. Drapes shall be provided under separate contract.

E. Alternate No. 5: Understory Fence

1. Base Bid: Includes no enclosure fencing around the open understory of the north portion of the building, and includes 8” angular rip rap ground cover over weed barrier fabric.
2. Alternate: Delete the rip rap. Provide steel fencing and locking gate by Section 055000 Metal Fabrications, concrete pier post foundations by Section 033000 and field painting by Section 099000. For ground cover in the understory area, provide 1” washed stone, 3” deep over weed barrier fabric.

END OF SECTION

SECTION 012500

SUBSTITUTION 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 administrative and procedural requirements for substitutions.

B. Related Sections:

1. Division 01 Section "Allowances" for products selected under an allowance.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Divisions 02 through 48 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 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 facsimile of form provided at end of Section.
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 modifications 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 and contribution to LEED credits as outlined in Section 010100, 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 three days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution by addendum.

a. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated or notification is not made by addendum.

1.5 QUALITY ASSURANCE

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

B. Products with asbestos: Asbestos containing materials are not to be purchased or installed in this project.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon 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. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Requested substitution won’t adversely affect the achievement of LEED credit as targeted.
c. Substitution request is fully documented and properly submitted.
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.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within the time indicated in A701 – Instructions to Bidders. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

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. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. 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)

SUBSTITUTION REQUEST FORM

Project:_____ Substitution Request Number:_____.
To:_____ From:_____.
Re:_____ Date: _____.

Specification Title: _____ Description: _____.
Section: _____Page: _____Article/Paragraph: _____.

Proposed Substitution: _____.
Manufacturer:_____Address:_____Phone:_____.
Trade Name:_____Model No._____.

Attached data includes product description, specifications, drawings, and performance and test data adequate for evaluation of the request: applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation.

The Undersigned certifies:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified product.
2. Will not adversely affect the achievement of LEED credit where targeted.
3. Will provide the same warranty for the Substitution as for the specified Product.
4. Will provide no additional cost to the Owner.
4. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
5. Waive claims for additional costs or time extension that may subsequently become apparent.
6. Will reimburse Owner and Architect/Engineer for review or redesign services associated with substitution.

Submitted By:_____.
Signed By:_____.
Firm:_____.
Address:_____.
Telephone:_____Fax:_____.

A/E's REVIEW AND ACTION

___Submission approved - Make submittals in accordance with Specification Section 013300.
___Submission approved as noted - Make submittals in accordance with Specification Section 013300.
___Submission rejected - Use specified materials.
___Submission request received too late - Use specified materials.

Signed by:_____Date:_____.

Supporting Data Attached: ___Drawings ___Product Data ___Samples ___Tests ___Reports
___Other_____.

END OF SECTION

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 01 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 Sections include the following:

1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
2. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
3. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

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 14 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 on Change Order Request form.

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 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
7. Change Order Request Form: Use CSI Form 13.6A “Change Order Request (Proposal)” with attachments CSI Form 13.6B "Proposal Worksheet Summary" and 13.6C "Proposal Worksheet Detail" or similar form approved by Owner.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit Price Adjustment: Refer to Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.6 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.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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 01 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 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
4. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
5. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of the submittal schedule.
6. Division 01 Section "Special Environmental Requirements" for administrative requirements governing submittal of cost breakdown information required for LEED documentation.

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 for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values correlated with each element.

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. Submit draft of request for payment form.
3. 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 of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

1) Labor.
2) Materials.
3) Equipment.

4. 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. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training in the amount of 5 percent of the Contract Sum.

a. Include separate line items under Contractor and principal subcontracts for LEED documentation and other project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. 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.

7. 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.
8. 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.
9. 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.

10. 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: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

    1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Materials previously stored and included in previous Applications for Payment.
    b. Work completed for this Application utilizing previously stored materials.
    c. Additional materials stored with this Application.
    d. Total materials remaining stored, including materials with this Application.

F. 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.

G. 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. The list of subcontractors, principal suppliers and fabricators shall be used to designate which entities involved in the Work must submit waivers. The list shall be approved by the Owner.
4. Owner reserves the right to designate which entities involved in the Work must submit waivers.
5. 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.
6. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

H. 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.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.

I. 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.

J. 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. Final submittal of record documents and operation and maintenance data.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. Evidence that claims have been settled.
6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
7. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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 01 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. General project coordination procedures.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Trades training as required by LEED for Homes – Mid-rise Multifamily Building program.
5. Requests for Interpretation (RFIs).
6. Project Web site.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

C. Related Sections include the following:

1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
4. Division 01 Section "General Commissioning Requirements" for coordinating the Work with Owner's commissioning authority.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 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 to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 KEY PERSONNEL

A. 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.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.7 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 RFIs.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. LEED for Homes – Mid-rise Multifamily Building program requirements.
l. Construction waste management.
m. Construction indoor air quality.
n. Preparation of Record Documents.
o. Use of the premises.
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.

s. Responsibility for temporary facilities and controls.
t. Procedures for moisture and mold control.
u. Procedures for disruptions and shutdowns.
v. Construction waste management and recycling.
w. Parking availability.
x. Office, work, and storage areas.
y. Equipment deliveries and priorities.
z. First aid.
aa. Security.
bb. Progress cleaning.

3. Minutes: Contractor will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

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: 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.

D. 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) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of proposal requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.
        19) LEED for Homes – Mid-rise Multifamily Building program submittals and requirements.
        20) Construction waste management.
        21) Construction indoor air quality.

3. Minutes: Contractor will record and distribute to Architect the meeting minutes.
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.

E. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing LEED for Homes – Mid-rise Multifamily Building program documents.
    e. Requirements for preparing operations and maintenance data.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Coordination of separate contracts.
    k. Owner's partial occupancy requirements.
    l. Installation of Owner's furniture, fixtures, and equipment.
    m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: 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 the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined 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.
    b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.

3. Reporting: Record meeting results and distribute copies to Architect and everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.8 TRADES TRAINING FOR MID-RISE

A. Before construction begins for each major trades, but after trades have been hired, hold a kick-off workshop focusing on the green aspects of the project and requirements for certification. Owner’s LEED consultant is responsible for workshop materials and training. Include the following trades:

    1. General contracting.
    2. Insulation.
    3. Plumbing.
    4. HVAC.

B. Coordinate with Architect for location and date of training.

1.9 REQUESTS FOR INTERPRETATION (RFIs)

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. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. 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.
12. Contractor's signature.
13. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

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

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven 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 weekly. 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

REQUEST FOR INFORMATION

Project: _____ R.F.I. Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Section: Paragraph: Drawings Reference: Detail:

Request:

Signed by:

Response:

___ Attachments

Response from: To: Date Rec'd Date Ret'd

Signed by:

Copies to:

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 01 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. Start-up construction schedule.
2. Contractor's Construction Schedule.
3. Material location reports.
4. Field condition reports.
5. Special reports.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

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.

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

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

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

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

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

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Two paper copies.

B. Start-up construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. Material Location Reports: Submit at monthly intervals.

E. Field Condition Reports: Submit at time of discovery of differing conditions.

F. Special Reports: Submit at time of unusual event.

G. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages and milestones.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

1.6 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 preparation and scheduling of submittals with LEED for Homes – Mid-rise Multifamily Building program requirements.

C. 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. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

    a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.

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

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work 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.

B. 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, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities

in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 5 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

C. 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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 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. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. 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. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

5. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure.
c. Completion of mechanical installation.
d. Completion of electrical installation.
e. Substantial Completion.

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

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

2.3 START-UP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work. 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 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.5 REPORTS

A. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

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 Information. 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 Architect within one day 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. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, review schedule for 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.

C. 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

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 Sections:

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.

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.

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 modifications to submittals noted by the Architect 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 start-up 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, informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled dates for installation.
    i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals. Contact Architect for details.

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. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough 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 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 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

    a. Sitework submittals.
    b. Commercial equipment submittals.
    c. Structural submittals.
    d. Mechanical submittals.
    e. Electrical submittals.
    f. Data & Communications Systems submittals.

5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
6. Submittals with Color Selections: Deliver to Architect a list of submittals required for the exterior color package and a list required for the interior color package. The Architect needs to coordinate the colors of all exterior and interior items and will hold submittals with color selections until all materials in the exterior color package have been received. Allow 2 weeks after the last item has been submitted for return of exterior color selections. The Architect will hold submittals with color selections until all materials in the interior color package have been received. Allow 3 weeks after the last item has been submitted for return of interior color selections. Careful coordination of the Submittal Schedule by the Contractor is required so as not to delay the Work.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals

shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

F. Options: Identify options requiring selection by the Architect.

G. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

H. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Use Contractor's standard transmittal form. Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Indication of full or partial submittal.
j. Drawing number and detail references, as appropriate.
k. Transmittal number, numbered consecutively.
l. Submittal and transmittal distribution record.
m. Remarks.
n. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

L. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Action Submittals: Submit three paper copies of each submittal, unless otherwise indicated. Architect will return two copies.
2. Informational Submittals: Submit two paper copies of each submittal, unless otherwise indicated. Architect will not return copies.
3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. 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 printed 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 LEED for Homes – Mid-rise Multifamily Building program.
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. Three paper copies of Product Data, unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based upon Architect's digital data drawing files is otherwise permitted.

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 40 inches.
3. Submit Shop Drawings in the following format:

a. Number of Copies: Submit 1 copy and 1 reproducible. Architect will return reproducible.

D. 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. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. 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.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Architect's action.

F. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

J. LEED Submittals: Comply with requirements specified in Division 01 Section "Special Environmental Requirements."

1. Submit LEED for Homes submittals in the following format:

a. Two paper copies of LEED for Homes submittals, unless otherwise indicated. Electronic submittals are also preferred.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

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

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

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

E. Installer Certificates: Prepare 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.

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

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

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

I. Material Test Reports: Prepare 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.

J. Product Test Reports: Prepare written reports indicating 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.

K. Research/Evaluation Reports: Prepare 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.

L. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

M. Preconstruction Test Reports: Prepare 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.

N. Compatibility Test Reports: Prepare 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.

O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

Q. Design Data: Prepare 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.

R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

U. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 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.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of 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.

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. 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: Refer to requirements in Division 01 Section "Closeout Procedures."

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.

1. Stamp or statement shall include the following: "The Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto or will do so, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents."

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

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

1. Approved: Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. Approved As Noted: Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
3. Revise and Resubmit or Not Approved: Returned for Resubmittal. Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark. Do not use, or allow others to use, submittals marked "Not Approved" or "Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
4. Action Not Required: Where a submittal is for information or record purposes or special processing or other activity

C. Informational Submittals: Architect 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.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 014000

QUALITY 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.

1.2 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-assurance and -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 other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 01 Section "Allowances" for testing and inspecting allowances.
2. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
3. Division 01 Section "Execution" for repair and restoration of construction disturbed by testing and inspecting activities.
4. Divisions 02 through 48 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and

completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size, physical assemblies constructed at testing facility to verify performance characteristics.
2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.

D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

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

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.

D. Testing Agency Qualifications: 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.

E. 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.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
4. Owner performed tests and inspections as required by LEED for Homes – Mid-rise Multifamily Building program, such as blower door test for building and several units, durability inspections, thermal bypass inspections.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. 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. Record of temperature and weather 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 reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. 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.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. 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.

C. 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, as well as sufficient production capacity to produce required units.

D. 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.

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 regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. 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.

J. 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.

K. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

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

L. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

M. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.

N. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 48.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated in individual specification sections as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made by Owner.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
7. Contractor is responsible for all coordinations necessary for required testing and inspections, even when Owner performs certain testing and inspections.

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 as specified in Division 01 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. 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.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -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.

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

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

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 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 Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

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

END OF SECTION

SECTION 014200

REFERENCES

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 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. Substantial Completion: Refer to the definition in General Conditions.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA	BOCA International, Inc. (See ICC)	
IBC	International Building Code	
ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
UBC	Uniform Building Code (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the

following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
USDA	Department of Agriculture www.usda.gov	(202) 720-2791

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
LEED	Leadership on Energy and Environmental Design USGBC – United States Green Building Council www.USGBC.org	(202) 828-7422
ASHRAE	XXXX	

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

MDEP	State of Maine Department of Environmental Protection
MDOT	State of Maine Department of Transportation

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014400

CONSTRUCTION INDOOR AIR QUALITY

PART 1 - GENERAL

1.1 SUMMARY

A. IAQ Management Goals.

B. IAQ Management Plan.

C. IAQ Management Plan Implementation.

1.2 IAQ MANAGEMENT GOALS

A. The 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.

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

C. Control sources of potential IAQ pollutants by controlling selection of materials and processes used in project construction. Construction site shall be a non-smoking area.

D. With regard to these goals the Contractor shall develop, for Owner and Architect's review, an IAQ Management Plan for this Project.

1.3 SUBMITTALS

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

B. Photographs 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.

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

D. Submit a letter from the Contractor describing building flushout procedures including actual dates of building flushout.

PART 2 - PRODUCTS

2.1 IAQ MANAGEMENT PLAN

A. Develop a Draft Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy 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 minimum two-week building flushout 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 of MERV 8 or better.
      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 13 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% outside air ventilation (when outside temperatures are between 55 degrees F and 85 degrees F and humidity is between 30% and 60%) 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 and Building system 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. As part of Indoor air quality management, the following requirements has to be met:

a. Preoccupancy Flush: Flush out each unit with fresh air , according to the following guidelines:

1) Flush prior to occupancy but after all phases of construction are completed.
2) Flush the entire unit, keeping all interior doors open.
3) Flush for 48 total hours; the hours may be nonconsecutive, if necessary.
4) Keep all windows open and run a fan (e.g., HVAC system fan) continuously or flush the home with all HVAC fans and exhaust fans operating continuously at the highest flow rate.
5) Use additional fans to circulate air within the home.
6) Replace or clean HVAC air filter afterward, as necessary.

B. Draft IAQ Management Plan Review Meeting: Once the Site Representative 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 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 and Architect for approval within 10 calendar days of the meeting.

PART 3 - EXECUTION

3.1 IMPLEMENTATION OF IAQ MANAGEMENT PLAN

A. Manager: The Contractor shall designate an on-site party (or parties) 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 pre-construction and construction progress meeting agendas.

C. Distribution: The Contractor shall distribute copies of the IAQ Management Plan to the Job Site Foreman, each Subcontractor, the Site Representative, and the Architect.

D. Instruction: The Contractor shall provide on-site instruction of the IAQ procedures and ensure that all participants in the construction process understand the importance of the goals of the IAQ Management Plan.

END OF SECTION

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 01 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 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 01 Section "Execution" for progress cleaning requirements.
4. Division 01 Section “Construction Indoor Air Quality” for IAQ requirements during construction.
5. Divisions 02 through 48 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.
6. Division 31 Section "Dewatering" for disposal of ground water at Project site.
7. Division 32 Section "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.3 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, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

E. Heating Fuel: Fuel required for temporary heating will be the responsibility of the Contractor.

F. Telephone/Fax Service: Pay service and use charges for telephone or data cable usage, by Contractor, at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

1. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

D. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of the work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air filtration system discharge.
4. Other dust-control measures.
5. Waste management plan.

E. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements to protect install concrete and masonry.

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.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

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.

B. Frost Protection: Protect footings from freezing temperatures and prevent frost from occurring beneath footings. Frozen water found on soil or concrete surface shall be reason for rejection of protection method. Provide corrective measures within 24 hours after notice of condition is given. Evidence of frost at these locations shall be reason for rejection, removal, and replacement at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vinyl Fencing: Standard 3 foot high, orange construction fence with steel posts.

B. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

C. 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.

D. 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.

E. Paint: Comply with requirements in Division 09 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. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of [**10**] <**Insert number**> individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack board.
3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. 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 gas/oil fired space heaters that are UL labeled and approved for construction space heating by appropriate agency. Provide adequate ventilation and thermostatic control. Heaters shall be located outside the building and combustion gases shall be vented outside the building. Maintain observation of units in operation.

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.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures".

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.

1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."

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.

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

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.

D. 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.

E. 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.

1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.

    a. Refer to Divisions 02 through 48 for additional temporary heat, ventilation, and humidity requirements for products in those Sections."

2. Provide temporary heat to protect all concrete and masonry work during installation as well as other trades needing specific heat requirements to perform and protect their work. See individual specification sections for detailed information.
3. All concrete slabs on grade, footings and foundations not below the frost line shall be protected from freezing either by heating or protecting with insulation until substantial completion.
4. Permanent air heating systems may be used to provide heat only when finishes are complete enough to eliminate construction dust and with the prior approval of the Architect and Owner. Pay for operating costs resulting from the use of the permanent heating system prior to "substantial completion" unless otherwise agreed to by the Owner. Extend warranty periods for such systems at the Contractor's expense so that the Owner gets the fully intended warranty period effective the day of "Substantial Completion".
5. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and replacement of filters and worn or consumed parts.

F. 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.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead, unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

H. 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.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine.

2. 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.

3. Provide an answering machine on superintendent's telephone.

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 Parking Areas: Construct and maintain temporary roads and parking areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and parking areas within construction limits indicated on Drawings.

1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the top 6 inches.
2. Provide gravel paving course of subbase material not less than 3 inches thick; roller compacted to a level, smooth, dense surface.
3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel as much as possible or utilize off-site parking.

E. 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.

F. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated. Include name of project, and names of Owner, Architect and Contractor. Comply with details indicated on the drawings.
2. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in size of 4 by 8 feet and 3/4 inch thickness, unless otherwise indicated. Support on posts or framing of preservative-treated wood or steel.
3. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
4. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

    a. Provide temporary, directional signs for construction personnel and visitors.

5. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."

H. 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.

I. Temporary Elevator Use: Not allowed.

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

K. Temporary Use of Permanent Stairs: Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.

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 01 Section "Summary."

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 Section "Site Clearing."

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: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Site Enclosure Fence: When excavation begins, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

F. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

H. 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.

I. 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 interior 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 hoses for fire protection of sufficient length to reach construction areas. 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 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

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

D. 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 01 Section "Closeout Procedures."

END OF SECTION

SECTION 016000

PRODUCT 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.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 01 Section "Allowances" for products selected under an allowance.
2. Division 01 Section "Alternates" for products selected under an alternate.
3. Division 01 Section "References" for applicable industry standards for products specified.
4. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
5. Division 01 Section “Special Environmental Requirements” for LEED for Homes program implementation.
6. Divisions 02 through 48 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 ACTION SUBMITTALS

A. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Products with asbestos: Asbestos containing materials are not to be purchased or installed in this project.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. LEED for Homes Considerations: Where possible, consider selecting products that are outlined in Division 01 Section “Special Environmental Requirements” and elsewhere within the Project Manual.

B. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved substitute" or approved," comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.

C. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Substitutions for Contractor's convenience will be considered, unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in Division 01 Section "Substitution Procedures" for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in Division 01 Section "Substitution Procedures" for consideration of an unnamed manufacturer.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in Division 01 Section "Substitution Procedures" for consideration of an unnamed product or manufacturer.

D. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.

E. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300

EXECUTION

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 general procedural requirements governing execution of the Work including, but not limited to, the following:

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

B. Related Sections:

1. Division 01 Section "Submittal Procedures" for submitting surveys.
2. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
3. Division 07 Section "Penetration Firestopping" for patching penetrations in 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 construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by land surveyor.

E. Final Property Survey: Submit 6 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. 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.

3. Other Construction Elements: Do not cut and patch other construction elements or 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.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction 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.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

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

1. For projects requiring compliance with sustainable design and construction practices and procedures, utilize products for patching that comply with requirements of Division 01 Section "Special Environmental Requirements."

B. In-Place Materials: Use materials for patching 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 provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities,mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: 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 authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. 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. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. 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. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. 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.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, 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. Temporary Support: Provide temporary support of work to be cut.

C. 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.

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

E. 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 neatly to minimum 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 31 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.

F. 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 practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical 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 minimize 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, prepare substrate and apply primer and intermediate paint coats appropriate for substrate 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.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. For general construction, each trade shall pick up the debris and rubbish, generated by that trade, and dispose of in dumpsters furnished by the General Contractor.

E. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

H. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. 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.

3.9 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 Division 01 Section "Quality Requirements."

3.10 PROTECTION OF 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. Protect resilient 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.

1. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
2. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

D. Protect roofing materials against cuts, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period.

1. Cover roofing products with plywood or suitable protection cover until inspection for Substantial Completion.
2. Do not move heavy and sharp objects directly over roof surfaces. Place plywood or hardboard panels over roofing and under objects while they are being moved. Slide or roll objects over panels without moving panels.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

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

END OF SECTION

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. Salvaging nonhazardous [**demolition**] [**and**] [**construction**] waste.
2. Recycling nonhazardous [**demolition**] [**and**] [**construction**] waste.
3. Disposing of nonhazardous [**demolition**] [**and**] [**construction**] waste.

B. Related Sections include the following:

1. Division 01 Section "Multiple Contract Summary" for coordination of responsibilities for waste management.
2. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction [**, and location of waste containers at Project site**].
3. Division 02 Section "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements[**, and for disposition of hazardous waste**].
4. Division 02 Section "Selective Structure Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements[**, and for disposition of hazardous waste**].
5. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
6. Division 04 Section "Stone Masonry" for disposal requirements for excess stone and stone waste.
7. 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 [**GOALS**] [**REQUIREMENTS**]

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 75 percent by weight of total waste generated by the Work and reduce construction waste to maximum 1 pound per SF of the project.

B. Salvage/Recycle: Owner's goal is to salvage and recycle as much nonhazardous [**demolition**] [**and**] [**construction**] waste as possible. Owner has established minimum goals for the following materials:

1. Demolition Waste:

a. Asphaltic concrete paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.

z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. 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. Gypsum board.
k. Piping.
l. Electrical conduit.
m. 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 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
8. A sample report is attached at the end of this section.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. LEED Submittal: LEED letter template for Credit MR 2.1[**and 2.2**], signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

H. 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.

1.7 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 comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
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.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis.[**Include separate sections in plan for demolition and construction waste.**] 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 [**demolition**] [**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. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. 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 salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by [**Architect**] [**Owner**] [**Construction Manager**]. 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. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. 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.

D. 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 salvaged, 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 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for [**Sale**] [**and**] [**Donation**]: [**Permitted**] [**Not permitted**] on Project site.

C. Salvaged Items for Owner's Use:

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 [**on-site**] [**off-site**] [**designated by Owner**].
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING [**DEMOLITION**] [**AND**] [**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). Recycler of construction and demolition without having to separate materials
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 Owner.

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.

3.4 RECYCLING DEMOLITION WASTE

A. Asphaltic Concrete Paving: Grind asphalt to maximum [**1-1/2-inch (38-mm)**] [**4-inch (100-mm)**] size.

1. Crush asphaltic concrete paving and screen to comply with requirements in Division 31 Section "Earth Moving" for use as general fill.

B. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.

C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum [**1-1/2-inch (38-mm)**] [**4-inch (100-mm)**] size.
2. Crush concrete and screen to comply with requirements in Division 31 Section "Earth Moving" for use as satisfactory soil for fill or subbase.

D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum [**3/4-inch (19-mm)**] [**1-inch (25-mm)**] [**1-1/2-inch (38-mm)**] [**4-inch (100-mm)**] size.

    a. Crush masonry and screen to comply with requirements in Division 31 Section "Earth Moving" for use as [**general fill**] [**satisfactory soil for fill or subbase**].
    b. Crush masonry and screen to comply with requirements in Division 32 Section "Plants" for use as mineral mulch.

2. Clean and stack undamaged, whole masonry units on wood pallets.

E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

F. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

H. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.

J. Carpet[**and Pad**]: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet[**and pad**] in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

L. Plumbing Fixtures: Separate by type and size.

M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

N. Lighting Fixtures: Separate lamps by type and protect from breakage.

O. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

P. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 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**] [**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.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

a. Comply with requirements in Division 32 Section "Plants." for use of clean ground gypsum board as inorganic soil amendment.

3.6 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

SECTION 017700

CLOSEOUT 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. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Inspection procedures.
3. Warranties.
4. Final cleaning.

B. Related Sections include the following:

1. Division 01 Section "Execution" for progress cleaning of Project site.
2. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
5. Division 01 “Special Environmental Requirements” for all LEED for Homes required documentation.
6. Divisions 02 through 48 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Prepare and submit all required LEED for Homes documentation.
7. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
8. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
9. Complete startup testing of systems.
10. Submit test/adjust/balance records.
11. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
12. Advise Owner of changeover in heat and other utilities.
13. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
14. Complete final cleaning requirements, including touchup painting.
15. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training DVDs.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:
5. Architect will submit list of incomplete items in the following format:

    a. One paper copy of product schedule or list, unless otherwise indicated.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or

installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

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

1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural

weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.

    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Construction Waste Management and Disposal."

END OF SECTION

SECTION 017823

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 01 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 and Maintenance manual as required by LEED for Homes program
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
4. Divisions 02 through 48 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect, LEED consultant and Commissioning Agent will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect, LEED consultant and Commissioning Agent will return copy with comments.

1. Correct or modify each manual to comply with Architect's, LEED consultant's and Commissioning Agent's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's, LEED consultant's and Commissioning Agent's comments and prior to commencing demonstration and training.

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 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

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 and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Agent.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. 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.

E. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type 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, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. 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 storage media 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 MANUALS

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 MANUALS

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, if available.

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 emergency, operation, and maintenance manuals.

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 01 Section "Project Record Documents."

F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 017839

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 01 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.
4. Miscellaneous record submittals.

B. Related Sections include the following:

1. Division 01 Section "Closeout Procedures" for general closeout procedures.
2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 02 through 48 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set 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.

D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy of each submittal.

PART 2 - PRODUCTS

2.1 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.

2.2 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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

2.3 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.

B. Format: Submit record Product Data as paper copy.

1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

2.4 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.

B. Format: Submit miscellaneous record submittals as paper copy.

1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 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

SECTION 017900

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 01 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 DVD’s.

B. Related Sections include the following:

1. Divisions 02 through 48 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit two 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 one complete training manual for Owner's use.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training DVD’s: Submit two copies within seven 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 and address of videographer.
c. Name of Architect.
d. Name of Contractor.
e. Date DVD 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 DVD. Include name of Project and date of DVD on each page.
3. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 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 for equipment not part of a system, as required by individual Specification Sections.

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 if Contractor is delegated design responsibility.
   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. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. 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. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. 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, a written or a demonstration performance-based test.

D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING DVD'S

A. General: Engage a qualified commercial photographer to record demonstration and training videotapes. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. Videotaped material shall be transferred to DVD.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. DVD Format: Provide standard 12 mm DVD.

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 DVD by audio narration by microphone while DVD is recorded or dubbing audio narration off-site after DVD 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.

F. Pre-Produced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION

SECTION 02 32 00

GEOTECHNICAL INVESTIGATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions apply to work of this Section.

1.2 DESCRIPTION OF WORK

Contractor shall review the geotechnical report and supplement prepared for the project by S. W. Cole Engineering of Portland, Maine. This report is appended to this section of Project Manual. During the Bidding Process, the Contractor may conduct his own subsurface investigations after requesting and receiving prior approval from the Owner. The request for approval shall be accompanied by a plan indicating the location and type of investigations to be undertaken by the Contractor. The Contractor is encouraged to verify Owner's subsurface investigations and shall notify the Owner in writing prior to the bid date of any discrepancies.

PART 2 - PRODUCTS

2.1 REPORT

A. Subsurface conditions have been investigated by three test borings. Locations of the test borings are shown on the contract drawings. Logs of the explorations are also appended to these specifications.

B. Said subsurface investigations are not warranted to show the actual subsurface conditions except at the location of said test borings or investigations, and at these points are subject to inaccuracies inherent in methods used and to variations in the classification and interpretation of soil layers.

Subsurface information is included only as an aid to the Bidder and it is the obligation of the Bidder to draw his own conclusions of subsurface conditions from his own investigations prior to submitting his proposal. The Contractor agrees, in signing his Contract, that he will make no claims against the Owner or Architect, if in carrying out the work he finds that the actual conditions encountered in performing the work do not conform to conditions presented, discussed, or anticipated prior to the commencement of work, the Contractor shall notify the Owner immediately of such differences in the conditions.

PART 3 - EXECUTION

3.1 REPORT REVIEW

A copy of the subsurface investigation reports are appended to the project manual and shall be considered part of the Contract Documents.

END OF SECTION 02 32 00

GEOTECHNICAL REPORT AND CORRESPONDENCE
PREPARED BY S. W. COLE ENGINEERING

(3827/21)

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED APARTMENT BUILDING
25 AND 29 CRESCENT STREET
PORTLAND, MAINE

08-0744 **October 24, 2008**

PREPARED FOR:

Developers Collaborative
Attention: Peter Bass
17 Chestnut Street, Suite 3
Portland, Maine 04101

PREPARED BY:

S.W.COLE ENGINEERING, INC.
17 Chestnut Street, Suite 1A
Portland, Maine 04101

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S.W.COLE ENGINEERING, INC. • Geotechnical Engineering • Field & Lab Testing • Scientific & Environmental Consulting

08-0744

October 24, 2008

Developers Collaborative
Attention: Peter Bass
17 Chestnut Street, Suite 3
Portland, Maine 04101

Subject: Geotechnical Engineering Services
Proposed Apartment Building
25 & 29 Crescent Street
Portland, Maine

Dear Mr. Bass:

In accordance with our Agreement, dated September 18, 2008, we have made a subsurface investigation for the proposed Apartment Building located at 25 & 29 Crescent Street in Portland, Maine. This report summarizes our findings and recommendations relative to geotechnical aspects of the proposed building construction. The contents of this report are subject to the limitations set forth in Attachment A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our investigation was to explore subsurface conditions within the proposed building footprint in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed building construction. Our scope of work included three test borings, a review of pertinent geotechnical data from adjacent Maine Medical Center projects and a geotechnical evaluation of the subsurface findings as they relate to the proposed building construction.

1.2 Proposed Construction

We understand that development plans call for demolition of two existing three-story apartment buildings to make way for a new four-story apartment building occupying both lots. Based on conceptual plans developed by Winton Scott Architects (project architect) and DeLuca-Hoffman Associates (project civil engineer), we understand the new apartment building will be an L-shaped structure occupying a footprint of approximately 4,000 SF situated over the footprints of the existing structures and extending down the slope toward Congress Street, principally on the 25 Crescent Street parcel. We understand the building will have a finished floor elevation of 125 feet, approximately level with Crescent Street and a basement floor elevation of 115 feet, approximately level with the basement elevations of the existing apartment buildings. Proposed and existing site features are shown on the "Exploration Location Plan" attached as Sheet 1.

The proposed apartment building will be situated east of the tie-back retaining wall for the recently constructed Maine Medical Center (MMC) Parking Garage. As discussed, we understand that SGH, Inc. (MMC Parking Garage Structural Engineer) will be engaged for foundation design and coordination to avoid conflicts with the tie-back anchors extending below portions of the proposed building. Structural loading information was not available at the time this report.

2.0 EXPLORATION AND TESTING

2.1 Exploration

Three test borings (B-501 through B-503) were made on the site on October 7 and 8, 2008. The test borings were made by Great Works Test Boring, Inc. of Rollinsford, New Hampshire working under subcontract to S. W. COLE ENGINEERING, INC. The explorations locations were selected and established in the field by S. W. COLE ENGINEERING, INC. based on taped measurements from existing site features. The approximate exploration locations are shown on the "Exploration Location Plan" attached as Sheet 1. Logs of the explorations are attached as Sheets 2 through 7. A key to the notes and symbols used on these logs is attached as Sheet 8. The ground surface elevations shown on the logs were estimated based on topographic information shown on Sheet 1.

S.W.COLE ENGINEERING, INC. completed subsurface explorations on the adjacent MMC properties from 2001 to 2004. Select test boring information from these previous explorations have been included in our evaluation of this project with express permission from MMC. These explorations are B-5, B-201 and B-205. The approximate locations of these previous explorations are shown on Sheet 1. Logs of these previous explorations are attached in Appendix A. It should be noted that several phases of excavation and construction have occurred since these previous explorations were completed.

2.2 Testing

The test borings were made using cased wash-boring and solid-stem auger drilling techniques. Soil samples were obtained within the test borings at intervals of 2, 5 and 10 feet using spilt spoon and Standard Penetration Test (SPT) methods. Pocket Penetrometer Tests (PPT) were made on split spoon samples where stiffer clay soils were encountered. SPT and PPT results are noted on the logs. The soils were returned to our laboratory for further visual classification and testing.

Laboratory testing was performed on the soils profile as part of the adjacent MMC Parking Garage Project. Results of this laboratory tests are included in Appendix A.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Conditions

The site is situated at 25 and 29 Crescent Street, north and east of the Maine Medical Center complex on the Western Promenade in Portland, Maine. The site is bounded by Congress Street on the north, Crescent Street on the south, the newly constructed MMC Parking Garage on the west and Residential property on the east. Surface relief across the site is varies greatly from about elevation 124 feet (project datum) along Crescent Street to about elevation 80 feet along Congress Street. Two residential apartment buildings existing on a terrace of land at about elevation 115 feet in the upper third of the site along Crescent Street. These residential structures have full basements that daylight on the north side and are buried on the south side along Crescent Street. North of the existing residential buildings, the site slopes steeply downward to Congress Street at an inclination of about 1.5H:1V.

A tied-back retaining wall exists along the western site boundary. The anchors for the tied back retaining wall extend under the western portion of the site, including below the western portions of the existing residential building. A mechanically stabilized earth (MSE) retaining wall exists at the bottom of the site slope along Congress Street. We understand the MSE Wall has geo-grid reinforcing that extends at least 15 feet behind the wall into the site.

3.2 Subsurface Conditions

Below a surficial layer of topsoil, the explorations generally encountered a soil profile consisting of silty sand with varying fractions of gravel, organics and ash (surficial fill) overlying brown to gray silt and sand with varying fractions of gravel and clay (glacial till). The principal strata encountered are summarized below. Not all the strata were encountered at each of the explorations; refer to the attached logs for more detail of the subsurface findings.

Surficial Fill: The surficial fills generally consisted of brown to gray silty sand with varying fractions of gravel. Scattered organics were generally noted in the upper portion of the fill and ash inclusions were noted in the fill at B-501. The surficial fills generally ranged from 5 to 11 feet thick and were found to be very loose to loose.

Glacial Till: Below the surficial fills, the test boring generally encountered a brown silt and sand with varying fractions of gravel, clay and occasional cobbles and boulders. The glacial till soils were brown (weathered) transitioning to gray (unweathered) with depth. The glacial till soils were found to be medium dense to very dense.

Bedrock: Refusal surfaces (probable bedrock) were not encountered within the depth explored at the explorations.

3.3 Groundwater Conditions

At the time of exploration, groundwater was not encountered within the explorations. The glacial till soil appeared moist becoming wet with depth. Groundwater should be anticipated to fluctuate seasonally, particularly following periods of precipitation and snowmelt.

3.4 Frost Penetration and Seismic Conditions

The design-freezing index for the Portland area is approximately 1250-Fahrenheit degree-days, which corresponds to a frost penetration depth on the order of 4.5 feet. According to IBC 2006, we interpret the site soils to correspond to a seismic soil Site Class D.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings and our understanding of the proposed project, construction of the proposed buildings appears feasible from a geotechnical standpoint. The principal geotechnical considerations include:

- Surficial fills, particularly on the slope, that are unsuitable for foundation and slab support,
- Steep slopes that require increased footing depths,
- Tie-back anchors from the adjacent MMC Parking Garage retaining wall that extend below the proposed building footprint,
- Overall stability of the adjacent MMC Parking Garage during and post-construction,
- Geogrid reinforcement and the stability of the MSE Wall along Congress Street,
- Excavation support for Crescent Street and existing utilities along Crescent Street,
- Demolition and backfilling of existing foundation and buried utilities within the proposed building footprint.

We understand that SGH, Inc. has been engaged to evaluate the stability of the adjacent MMC Parking Garage Retaining Wall relative to the proposed construction. It will be particularly important to coordinate foundation elements to avoid conflicts with the existing anchorage systems of the MMC Parking Garage Retaining Wall and MSE Wall along Congress Street. Additionally, it will be important to evaluate potential impacts during construction, particularly during the demolition and excavation phases of work when existing overburden loads are removed.

4.2 Site and Subgrade Preparation

Site preparation should begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Proposed construction areas should be cleared and grubbed of all organic matter and topsoil. As much vegetation as possible should remain over inactive areas of construction to lessen the potential for erosion and site disturbance. We recommend that existing foundations, slabs and buried utilities beneath the proposed building footing print be completely removed and backfilled with compacted Structural Backfill.

Terrace Area of Building Pad: Based on the subsurface findings and our understanding of the proposed construction, we anticipate that footings on the upper terrace of the site, generally within the footprint of the existing buildings, will encounter medium dense to dense glacial till soils or compacted Structural Backfill. For footings is this area, we recommend that excavation be completed with a smooth-edged bucket and subgrades be protected with 6 inches of crushed stone placed over woven geotextile fabric such as Mirafi 500X.

Sloping Area of Building Pad: Based on the subsurface findings and our understanding of the proposed construction, we anticipate that footings on the sloping portion of the site will encounter surficial fills that are unsuitable for direct foundation support. For footing subgrades in the slope area of the building pad, we recommend either removing the existing fills and backfilling with compacted Structural Fill or improving the soils with geo-piers (stone columns) extending through the unsuitable soils to be founded in underlying dense glacial till soils. Removing and backfilling the unsuitable soils would require displacing soil from the site and importing suitable structural fill. The limits of excavation for unsuitable fill removal should extend 1 foot laterally outward from the building footprint for each foot of excavation depth, unless footings are founded at the elevation of dense glacial till. Alternately, the unsuitable fills could be improved by using geo-piers (stone columns) extending through the unsuitable soils. Geo-piers require auguring holes through the unsuitable fills to the underlying glacial till and backfill with compacted crushed stone. The geo-pier option has the ability to transmit new foundation loads deeper in order to resolve potential limitations with the MSE Wall along Congress Street. For both options, we recommend constructing an additional basement level over the sloping area of the building pad at a finished floor elevation of approximately 103 feet. This would create a basement foundation that is benched into

the site and daylights along north side of the building at two elevations (approximate elevation 115 and 103 feet). Our recommendation for two basement levels is depicted on Sheet 1.

4.3 Foundation and Basement Walls

Based on the subsurface findings and our understanding of the proposed construction, foundation support for the proposed building can be provided by spread footing foundations founded on properly prepared subgrades as presented herein. For spread footings founded on properly prepared subgrades, we recommend the following geotechnical parameters for design of spread footings for the retail building:

• Design Frost Depth	4.5 feet (level ground)
• Net Allowable Bearing Capacity	4.0 ksf or less
• Base Friction Factor	0.40
• Total post-construction settlement	1-inch or less
• Differential post-construction settlement	¾-inch
• Total unit weight of backfill (γt)	125 pcf
• At-rest Lateral Earth Pressure Coefficient	0.5 (restrained walls)
• Surcharge Lateral Earth Pressure Coeff.	0.5
• Passive Lateral Earth Pressure Coeff.	3.0 (ultimate value)

Footings placed on sloping areas of the site must be founded deeper than the design frost depth for proper bearing and frost protection. S.W.COLE ENGINEERING, INC must be engaged to review the foundation design and layout prior to construction, particularly with regard to footings placed on slopes.

Foundation and basement walls that are restrained from rotation should be designed considering the at-rest lateral earth pressures. According to IBC 2006, we interpret the subsurface conditions to correspond to a seismic soil Site Class D.

4.4 Foundation Drainage

We recommend that foundation underdrains be provided around the exterior of perimeter foundations as well below interior portions of basement slabs on the upslope side of the proposed building. The underdrains may consist of 4-inch diameter HDPE

slotted underdrain pipe with filter sock enveloped in at least 6 inches of Underdrain Sand and backfilled with free-draining sand and gravel meeting the requirements of Structural Fill as given herein. The underdrains should be installed at footing subgrade elevation and routed to a positive gravity outlet. Roof drains must be routed in separate tight-line pipes.

4.5 On-Grade Floor Slabs

On-grade floor slabs in heated spaces may be designed using a subgrade reaction modulus of 150 pci provided the slab is underlain by at least 12 inches of Structural Fill overlying a properly prepared subgrade. We recommend the existing unsuitable fills below the slab in the sloping area of the site be removed and replaced with compacted structural fill. We recommend that a 10-mil vapor barrier be placed directly below the floor slabs to help retard the transmission of moisture vapors.

We recommend that control and construction joints be installed within floor slabs to accommodate shrinkage in the concrete as it cures and that the slab be wet-cured for a period of at least 7 days after casting as a measure to reduce the potential for curling of the concrete and excessive drying/shrinkage.

4.6 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 given herein 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 bottom of the adjacent sidewalk or pavement subbase gravel at a 3H:1V or flatter slope.

It must be understood that without complete removal of existing soils with non-frost susceptible soil for the full depth of frost penetration, some frost related movement of the sidewalks will occur.

4.7 Backfill and Compaction

Based on the subsurface findings, the existing surficial fills are frost susceptible and unsuitable for reuse as compacted Structural Fill beneath building areas and as foundation backfill.

Structural Fill: Backfill beneath buildings, floor slabs and entrance slabs, as well as against foundations and basement walls should be a 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

Underdrain Sand: Clean, free-draining underdrain sand used for underdrains should meet the requirements for MDOT Standard Specification 703.22 Type B "Underdrain Aggregate" as given below.

MDOT 703.22 Type B Underdrain Sand	
Sieve Size	**Percent Finer by Weight**
1 inch	95 to 100
½ inch	75 to 100
#4	50 to 100
#20	15 to 80
#50	0 to 15
#200	0 to 5
NOTE: Minimum Permeability of $1x10^{-3}$ cm/sec or faster.	

Crushed Stone: Crushed stone, if used, for working mats over footing subgrade should meet the requirements for MDOT Standard Specification 703.22 Type C "Underdrain Aggregate" as given below. A nominal sized uniformly graded ¾-inch washed crushed stone generally meets this gradation requirement.

MDOT 703.22 Type C Underdrain Stone	
Sieve Size	**Percent Finer by Weight**
1 inch	100
¾ inch	90 to 100
3/8 inch	0 to 75
#4	0 to 25
#10	0 to 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 and fill activities generally performed with should not exceed 12 inches. We recommend that fill and backfill in building areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Fill placed within landscape areas should be compacted to at least 90 percent of its maximum dry density as determined by ASTM D-1557. Backfill against basement walls should be compacted to between 90 to 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed stone should be compacted to 100 percent of its dry rodded unit weight per ASTM C-29.

4.8 Weather Considerations

Based on Climatological data obtained from the National Oceanic and Atmospheric Administration, it appears that average monthly precipitation totals are relatively uniform during the construction season. For this reason, it should be anticipated that relatively dry or wet conditions might occur at any time during the year. Construction activity should be limited during wet weather and the site may require drying before construction activities may continue.

If foundation construction takes place during winter and spring, subgrades, foundations and slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil and once the concrete is placed, the soil beneath the structure must be protected from freezing. In all cases, sitework and construction activities should take appropriate measures to protect exposed subgrades.

4.9 Design Review and Construction Testing

It is recommended that S. W. COLE ENGINEERING, INC. be engaged to review the sitework and foundation design drawings to determine that our interpretation of the subsurface conditions and recommendations have been appropriately interpreted and implemented.

S.W.COLE ENGINEERING, INC. should be provided foundation plans and loads in order to assess global stability assessment of the site. We understand that SGH, Inc will assess stability of the existing MMC Parking Garage Retaining Wall and Tie-Back Anchors.

S. W. COLE ENGINEERING, INC. should be retained to provide soils engineering and testing services during the earthwork and foundation phases of construction. This is to observe compliance with the design concepts, specifications, and design recommendations and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to the start of construction. S. W. COLE ENGINEERING, INC. is available to provide construction observation and testing services for soils, concrete, masonry, structural steel, spray-applied fireproofing and asphalt paving.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project and we look forward to working with you as design progresses and during construction. If you have any questions of if we may be of further assistance, please do not hesitate to contact us.

Sincerely,

S.W.COLE ENGINEERING, INC.

Timothy J. Boyce, P.E.
Senior Geotechnical Engineer

TJB:cbm

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ATTACHMENT A
LIMITATIONS

This report has been prepared for the exclusive use of Developer Collaborative for specific application to proposed Apartment Building located at 25 & 29 Crescent Street 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.

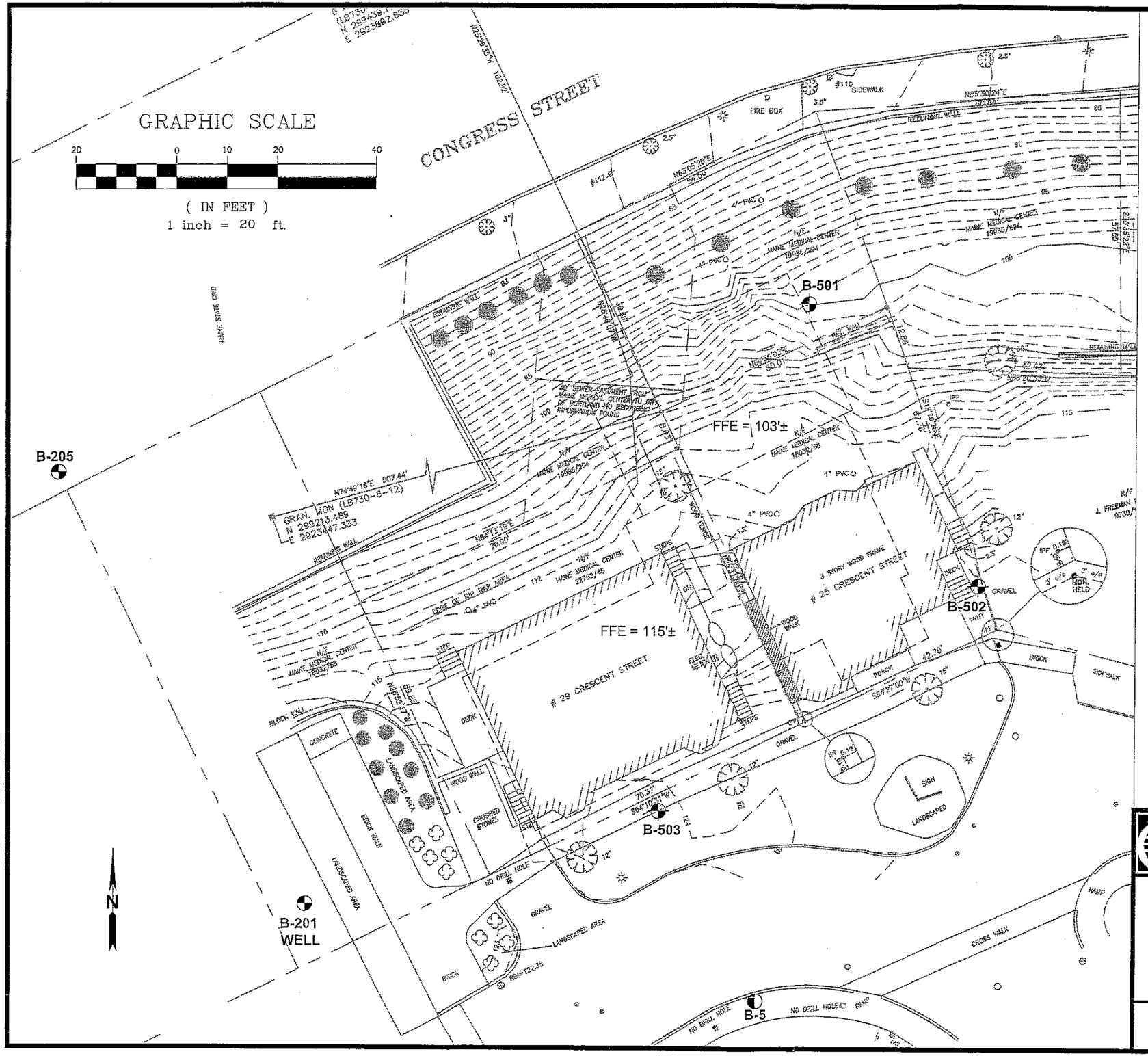
The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

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.

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.

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.

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.



LEGEND

- Approximate Location of Test Borings
- Approximate Location of Test Borings made in May 2001for a Preliminary Investigation for the Proposed Women and Infants Project (SWC Project No. 01-0304)
- Approximate Location of Test Borings made in January / February 2004 for the Proposed Parking Garage Project (SWC Project No. 02-0067.1)

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=20' SCALE PLAN OF THE SITE ENTITLED "CRESENT STREET APARTMENTS, EXISTING CONDITONS", PREPARED BY DELUCA HOFFMAN ASSOCIATES, INC., UNDATED.
2. THE BORINGS WERE LOCATED IN THE FIELD BY TAPED MEASUREMENTS FROM EXISTING SITE FEATURES.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE REPORT ENTITLED "GEOTECHNICAL ENGINEERING SERVICES, PROPOSED APARTMENT BUILDING, 25 & 29 CRESENT STREET, PORTLAND, MAINE", DATED OCTOBER 24, 2008.
4. 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.

S.W.COLE ENGINEERING, INC.

DEVELOPERS COLLABORATIVE

EXPLORATION LOCATION PLAN

PROPOSED APARTMENT BUILDING
22 AND 29 CRESCENT STREET
PORTLAND, MAINE

Job No. 08-0744 S
Date : 10/24/08

Scale 1" = 20'
Sheet 1

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S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-501
SHEET: 1 OF 2
PROJECT NO.: 08-0744
DATE START: 10/7/2008
DATE FINISH: 10/7/2008
ELEVATION: 100' +/-
SWC REP.: K. GIMPEL

PROJECT / CLIENT: PROPOSED APARTMENT BUILDING / DEVELOPERS COLLABORATIVE
LOCATION: 25 & 29 CRESCENT STREET, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING, INC DRILLER: WILL AIKMAN

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0"	300-lb	18"
SAMPLER:	SS	1 3/8"	140-lb	30"
CORE BARREL:	N/A			

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

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
SSA										BROWN SILTY SAND TRACE GRAVEL WITH ASH AND ORGANICS (FILL)
	1D	24"	12"	2.0'	12	1	1	1		
	2D	24"	4"	4.0'	3	4	12	15		~ VERY LOOSE TO LOOSE ~
									5.1'	
	3D	6"	6"	5.5'	7	25/0"				BROWN GRAVELLY SILTY SAND WITH COBBLES AND BOULDERS (FILL)
▼									7.0'	~ LOOSE ~
CASING										GRAY SILTY SAND SOME GRAVEL TRACE CLAY WITH COBBLES (TILL FILL)
TO 10'										
▼	4D	2.0'	2.0'	10.0'	AUGER FLIGHT SAMPLE				9.5'	~ LOOSE ~
OPEN										GRAY SAND AND SILT SOME GRAVEL TRACE CLAY (TILL)
HOLE	5D	24"	17"	12.0'	7	9	25	18		
	6D	24"	16"	17.0'	9	11	10	14		~ MEDIUM DENSE ~
	7D	24"	0"	22.0'	8	7	9	14		
	8D	24"	0"	27.0'	9	11	12	20		
									31.0'	
	9D	24"	0"	32.0'	14	18	25	32		GRAY GRAVELLY SAND AND SILT TRACE CLAY WITH COBBLES (TILL) ~ DENSE TO VERY DENSE ~
	10D	24"	0"	37.0'	26	24	30	30		
▼										

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[ ] LABORATORY TEST

REMARKS: AUGER REFUSAL @ 7.5' DUE TO BOULDERS (RELIC STONE WALL / FNDN) OFFSET 3-FEET AND CONTINUED DRILLING
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-501

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-501
SHEET: 2 OF 2
PROJECT NO.: 08-0744
DATE START: 10/7/2008
DATE FINISH: 10/7/2008
ELEVATION: 100' +/-
SWC REP.: K. GIMPEL

PROJECT / CLIENT: PROPOSED APARTMENT BUILDING / DEVELOPERS COLLABORATIVE
LOCATION: 25 & 29 CRESCENT STREET, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING, INC DRILLER: WILL AIKMAN

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0"	300-lb	18"
SAMPLER:	SS	1 3/8"	140-lb	30"
CORE BARREL:	N/A			

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

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
OPEN										GRAY GRAVELLY SAND AND SILT WITH COBBLES (TILL)
HOLE	11D	24"	6"	42.0'	23	44	35	48		~ VERY DENSE ~
	12D	18"	12"	46.5'	30	34	50		46.5'	
										BOTTOM OF EXPLORATION @ 46.5 FEET

SAMPLES:
D = SPLIT SPOON
C = 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-501

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-502
SHEET: 1 OF 2
PROJECT NO.: 08-0744
DATE START: 10/7/2008
DATE FINISH: 10/8/2008
ELEVATION: 124' +/-
SWC REP.: K. GIMPEL

PROJECT / CLIENT: PROPOSED APARTMENT BUILDING / DEVELOPERS COLLABORATIVE
LOCATION: 25 & 29 CRESCENT STREET, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING, INC DRILLER: WILL AIKMAN

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0"	300-lb	18"
SAMPLER:	SS	1 3/8"	140-lb	30"
CORE BARREL:	N/A			

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

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
SSA										DARK BROWN SILTY SAND WITH ORGANICS (FILL)
	1D	24"	6"	2.0'	WOH	2	3	5	2.0'	~ LOOSE ~
										BROWN SILTY SAND TRACE ORGANICS (FILL)
										~ LOOSE ~
									5.0'	
CASING	2D	4"	2"	5.3'	50/4"					BROWN GRAVELLY SAND TRACE SILT WITH COBBLES
TO 10'										~ DENSE ~
	3D	24"	12"	8.0'	30	17	22	30		[BOULDER ENCOUNTERED BETWEEN 9 AND 10.5']
OPEN									10.5'	
HOLE	4D	12"	8"	11.5'	33	50				BROWN SAND AND SILT
										SOME GRAVEL TRACE CLAY WITH COBBLES (TILL)
										~ DENSE ~
	5D	24"	24"	17.0'	18	15	15	20		[BOULDER ENCOUNTERED BETWEEN 18 AND 19.5']
	6D	24"	24"	22.0'	7	12	13	12	23.0'	
	7D	24"	24"	27.0'	5	8	6	8		GRAY CLAYEY SILT AND SAND TRACE GRAVEL
										WITH OCCASIONAL COBBLES (TILL)
										~ MEDIUM DENSE ~
	8D	24"	24"	32.0'	5	4	7	7		
	9D	24"	6"	37.0'	16	17	14	19	38.0'	
										GRAY SAND AND SILT SOME GRAVEL TRACE CLAY (TILL)
										~ DENSE ~

SAMPLES:
D = SPLIT SPOON
C = 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-502

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-502
SHEET: 2 OF 2
PROJECT NO.: 08-0744
DATE START: 10/7/2008
DATE FINISH: 10/8/2008
ELEVATION: 124' +/-
SWC REP.: K. GIMPEL

PROJECT / CLIENT: PROPOSED APARTMENT BUILDING / DEVELOPERS COLLABORATIVE
LOCATION: 25 & 29 CRESCENT STREET, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING, INC DRILLER: WILL AIKMAN

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0"	300-lb	18"
SAMPLER:	SS	1 3/8"	140-lb	30"
CORE BARREL:	N/A			

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

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
	10D	22"	17"	41.8'	16	25	26	50/4"		GRAY SAND AND SILT SOME GRAVEL TRACE CLAY (TILL) ~ DENSE TO VERY DENSE ~
	11D	24"	24"	47.0'	11	16	22	30		
	12D	24"	14"	52.0'	20	20	22	46		
	13D	24"	24"	57.0'	9	11	12	21		
	14D	24"	12"	62.0'	11	17	30	39	62.0'	
										BOTTOM OF EXPLORATION @ 62.0 FEET

SAMPLES:
D = SPLIT SPOON
C = 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-502

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-503
SHEET: 1 OF 2
PROJECT NO.: 08-0744
DATE START: 10/8/2008
DATE FINISH: 10/8/2008
ELEVATION: 124 +/-
SWC REP.: K. GIMPEL

PROJECT / CLIENT: PROPOSED APARTMENT BUILDING / DEVELOPERS COLLABORATIVE
LOCATION: 25 & 29 CRESCENT STREET, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING, INC DRILLER: WILL AIKMAN

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0"	300-lb	18"
SAMPLER:	SS	1 3/8"	140-lb	30"
CORE BARREL:	N/A			

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

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
SSA									0.2'	BROWN SILTY SAND WITH ORGANICS (TOPSOIL)
	1D	24"	16"	2.0'	3	14	10	7	1.8'	BROWN GRAVELLY SILTY SAND (FILL)
	2D	24"	12"	4.0'	4	4	3	3		BROWN SAND TRACE SILT TRACE GRAVEL (FILL) ~ LOOSE ~ [BORING LOCATED 1-FOOT OFF CATCH BASIN LOCATION]
CASING										
TO 15'	3D	24"	17"	7.0'	2	1	1	1		
	4D	24"	12"	9.0'	2	1	1	2		
									10.2'	
	5D	24"	10"	12.0'	5	1	1	8	11.5'	BROWN SAND AND SILT (REWORKED / FILL)
									12.5'	~ MEDIUM DENSE ~ GRAY SILT AND SAND
OPEN										BROWN SAND AND SILT TRACE GRAVEL TRACE CLAY (TILL) ~ MEDIUM DENSE TO DENSE ~
HOLE	6D	24"	24"	17.0'	10	11	13	15		
	7D	24"	14"	22.0'	7	11	13	14		
									26.0'	
	8D	24"	24"	27.0'	6	7	7	10		GRAY SAND AND SILT TRACE GRAVEL TRACE CLAY (TILL) ~ MEDIUM DENSE TO VERY DENSE ~
	9D	24"	24"	32.0'	8	14	15	16		[BOULDER ENCOUNTERED BETWEEN 34.5 AND 35.5']
	10D	24"	12"	37.5'	12	49	37	22		

SAMPLES:
D = SPLIT SPOON
C = 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-503

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-503
SHEET: 2 OF 2
PROJECT NO.: 08-0744
DATE START: 10/8/2008
DATE FINISH: 10/8/2008
ELEVATION: 124 +/-
SWC REP.: K. GIMPEL

PROJECT / CLIENT: PROPOSED APARTMENT BUILDING / DEVELOPERS COLLABORATIVE
LOCATION: 25 & 29 CRESCENT STREET, PORTLAND, MAINE
DRILLING CO. : GREAT WORKS TEST BORING, INC DRILLER: WILL AIKMAN

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4.0"	300-lb	18"
SAMPLER:	SS	1 3/8"	140-lb	30"
CORE BARREL:	N/A			

WATER LEVEL INFORMATION
NO FREE WATER OBSERVED

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
	11D	24"	12"	42.0'	18	20	25	24		GRAY SAND AND SILT TRACE GRAVEL TRACE CLAY (TILL) ~ DENSE TO VERY DENSE ~
	12D	24"	22"	47.0'	15	19	25	25		
	13D	24"	23"	52.0'	38	35	21	25		
	14D	24"	24"	57.0'	12	12	18	24		
	15D	24"	24"	62.0'	21	20	24	28	62.0'	
										BOTTOM OF EXPLORATION @ 62.0 FEET

SAMPLES:
D = SPLIT SPOON
C = 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-503

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.

APPENDIX A

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-5
SHEET: 1 OF 1
PROJECT NO.: 01-0304 S
DATE START: 5/18/2001
DATE FINISH: 5/18/2001
ELEVATION: 125.5'+/-
SWC REP.: KBG

PROJECT / CLIENT: PROPOSED MEDICAL OFFICE BUILDING / MAINE MEDICAL CENTER
LOCATION: CHARLES STREET PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORINGS DRILLER: DON

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HSA	4 1/4"		
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS MOIST BELOW 14.0'
SOILS SATURATED BELOW 24.5'

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
									.5'	ASPHALT PAVEMENT
	S-1	24"	10"	2.0'	9	13	19	20	3.5'	~DENSE~ BROWN SAND AND GRAVEL W/SOME SILT (FILL) w=9.2%
	S-2	14"	11"	7.0'	21	36	50/2"		8.0'	~VERY DENSE~ BROWNISH GRAY GRAVELLY SANDY SILT (FILL) w=7.0%
	S-3	24'	18"	12.0'	15	32	37	38		~VERY DENSE~ BROWNISH GRAY SAND AND SILT W/SOME GRAVEL (TILL) w=9.3% w=13.8%
	S-4	24"	21"	17.0'	10	17	13	12		~MEDIUM SENSE~
	S-5	24"	24"	22.0'	6	18	17	16	24.5'	w=13.8%
	S-6	24"	6"	27.0'	2	8	9	5	28.0'	BROWNISH GRAY SANDY CLAY W/SOME GRAVEL w=34.1% ~MEDIUM DENSE/STIFF~
		24"	0	32.0'	12	21	29	21		GRAY SAND AND SILT W/TRACE GRAVEL (TILL) ~DENSE~
	S-7	24"	24"	37.0'	11	14	14	29	37.0'	w=14.0%
										BOTTOM OF EXPLORATION AT 37.0' (NO REFUSAL)

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-5

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-201
SHEET: 1 OF 3
PROJECT NO.: 02-0067.1 S
DATE START: 2/27/2004
DATE FINISH: 3/1/2004
ELEVATION: 124'+/-
SWC REP.: ARS / KBG / ELJ

PROJECT: PROPOSED PARKING GARAGE
CLIENT: MAINE MEDICAL CENTER
LOCATION: PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORING DRILLER: WAYNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	16"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
PIEZOMETER INSTALLED

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									0.5'	CRUSHED STONE (FILL)
CASING									2.0'	BROWN SILTY SAND, SOME GRAVEL (FILL)
	1D	24"	10"	7.0'	3	3	2	2	9.0'	DARK BROWN SILTY SAND, SOME GRAVEL (FILL) ~ LOOSE ~
	2D	24"	16"	12.0'	18	21	20	8	11.0'	BROWN SILTY SAND AND GRAVEL, BRICK AND CONCRETE PIECES (FILL) ~ DENSE ~
	3D	24"	18"	17.0'	30	31	33	38	13.0'	BROWN GRAVELLY SAND, SOME SILT ~ DENSE ~
	4D	24"	20"	22.0'	50	46	52	31	18.0'	BROWN GRAVELLY SAND, TRACE TO SOME SILT ~ VERY DENSE ~
	5D	24"	24"	27.0'	8	7	9	7	28.0'	~ VERY DENSE ~ GRAY SAND AND SILT WITH SOME CLAY AND GRAVEL (TILL) W = 9.6% γ_T = 142+/- pcf W = 10.9% Wl = 18 Wp = 11
OPEN HOLE	6D	24"	24"	32.0'	9	9	11	11	39.0'	GRAY SILTY CLAY WITH TRACE SAND ~ HARD BECOMING . . . W = 24.9% qp = 9 to 9+ ksf Wl = 44 Wp = 18 . . . VERY STIFF ~ W = 32.2% qp = 5 to 6 ksf
	7D	24"	24"	37.0'	6	9	13	17		GRAY TILL (SEE NEXT SHEET)

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-201

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-201
SHEET: 2 OF 3
PROJECT NO.: 02-0067.1 S
DATE START: 2/27/2004
DATE FINISH: 3/1/2004
ELEVATION: 124'+/-
SWC REP.: ARS / KBG / ELJ

PROJECT: PROPOSED PARKING GARAGE
CLIENT : MAINE MEDICAL CENTER
LOCATION: PORTLAND, MAINE
DRILLING FIRM: GREAT WORKS TEST BORING DRILLER: WAYNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	16"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
PIEZOMETER INSTALLED

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
OPEN HOLE	8D	24"	20"	42.0'	16	17	29	29		GRAY SAND AND SILT WITH SOME CLAY AND GRAVEL WITH OCCASIONAL COBBLES (TILL) W = 9.6% ~ VERY DENSE ~
	9D	24"	18"	47.0'	17	25	25	40		
	10D	24"	24"	52.0'	11	21	25	25		γ_T =151+/- pcf W = 11.3% Wl = 19.0 Wp = 11.0
	11D	11"	0"	55.8'	35	50/5"				GRAY CLAYEY SILT AND SAND WITH TRACE GRAVEL OCCASIONAL COBBLES (TILL) W = 15.9%
	12D	18"	18"	61.5'	17	32	38	25/0		GRAY SAND AND SILT WITH SOME CLAY AND GRAVEL OCCASIONAL COBBLES (TILL) ~ DENSE ~
	13D	10"	6"	65.8'	19	50/5"				
	14D	24"	24"	72.0'	21	18	25	38		W = 10.1%
	15D	24"	24"	77.0'	19	19	27	19		γ_T =151+/- pcf W = 8.5% Wl = 18 Wp = 12

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-201

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-201
SHEET: 3 OF 3
PROJECT NO.: 02-0067.1 S
DATE START: 2/27/2004
DATE FINISH: 3/1/2004
ELEVATION: 124'+/-
SWC REP.: ARS / KBG / ELJ

PROJECT: PROPOSED PARKING GARAGE
CLIENT: MAINE MEDICAL CENTER
LOCATION: PORTLAND, MAINE
DRILLING FIRM: MAINE TEST BORINGS, INC DRILLER: WAYNE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	16"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
PIEZOMETER INSTALLED

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
OPEN										~ MDENSE ~
HOLE	16D	24"	24"	82.0'	16	15	17	22		GRAY SAND AND SILT WITH SOME CLAY AND GRAVEL
										OCCASIONAL COBBLES (TILL)
	17D	24"	24"	92.0'	25	33	40	41		~ VERY DENSE ~
▼	18D	3"	3"	102.0'	50/3"				102.0'	
										BOTTOM OF EXPLORATION AT 102.0'

NOTES :
1.) TOP 2'+/- FROZEN
2.) PIEZOMETER INSTALLED
3.) 3" DIAMETER SPOON WITH 300 LB HAMMER USED FOR USED FOR SAMPLES 5D, 10D AND 15D

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-201

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-205
SHEET: 1 OF 2
PROJECT NO.: 02-0067.1 S
DATE START: 3/2/2004
DATE FINISH: 3/2/2004
ELEVATION: 74'+/-
SWC REP.: KBG

PROJECT: PROPOSED PARKING GARAGE
CLIENT : MAINE MEDICAL CENTER
LOCATION: PORTLAND, MAINE
DRILLING FIRM: MAINE TEST BORINGS, INC DRILLER: PETE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	16"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEARED WET TO SATURATED
TOP 5' AND BELOW 10'+/-

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 CASING									0.5'	BRICK SIDEWALK
									3.0'	BROWN SILTY SAND WITH SOME GRAVEL (FILL)
	1D	24"	17"	5.0'	15	9	6	8		GRAY SAND AND SILT, TRACE GRAVEL, SOME CLAY (TILL) OCCASIONAL COBBLES W = 11.1% ~ MEDIUM DENSE ~
	2D	24"	18"	7.0'	7	6	5	7		
OPEN HOLE	3D	24"	22"	12.0'	4	5	9	15		
	4D	24"	20"	17.0'	6	9	10	12		
	5D	24"	24"	22.0'	8	11	11	45		W = 9.9%
	6D	24"	20"	27.0'	10	35	35	20		~ VERY DENSE ~
	7D	24"	24"	32.0'	6	8	12	16		~ MEDIUM DENSE ~
	8D	24"	24"	37.0'	8	8	12	18		

SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-205

S.W.COLE ENGINEERING, INC.

BORING LOG

BORING NO.: B-205
SHEET: 2 OF 2
PROJECT NO.: 02-0067.1 S
DATE START: 3/2/2004
DATE FINISH: 3/2/2004
ELEVATION: 74'+/-
SWC REP.: KBG

PROJECT: PROPOSED PARKING GARAGE
CLIENT: MAINE MEDICAL CENTER
LOCATION: PORTLAND, MAINE
DRILLING FIRM: MAINE TEST BORINGS, INC DRILLER: PETE

	TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL
CASING:	HW	4"	300 LB	16"
SAMPLER:	SS	1 3/8"	140 LB	30"
CORE BARREL:				

WATER LEVEL INFORMATION
SOILS APPEARED WET TO SATURATED
TOP 5' AND BELOW 10'+/-

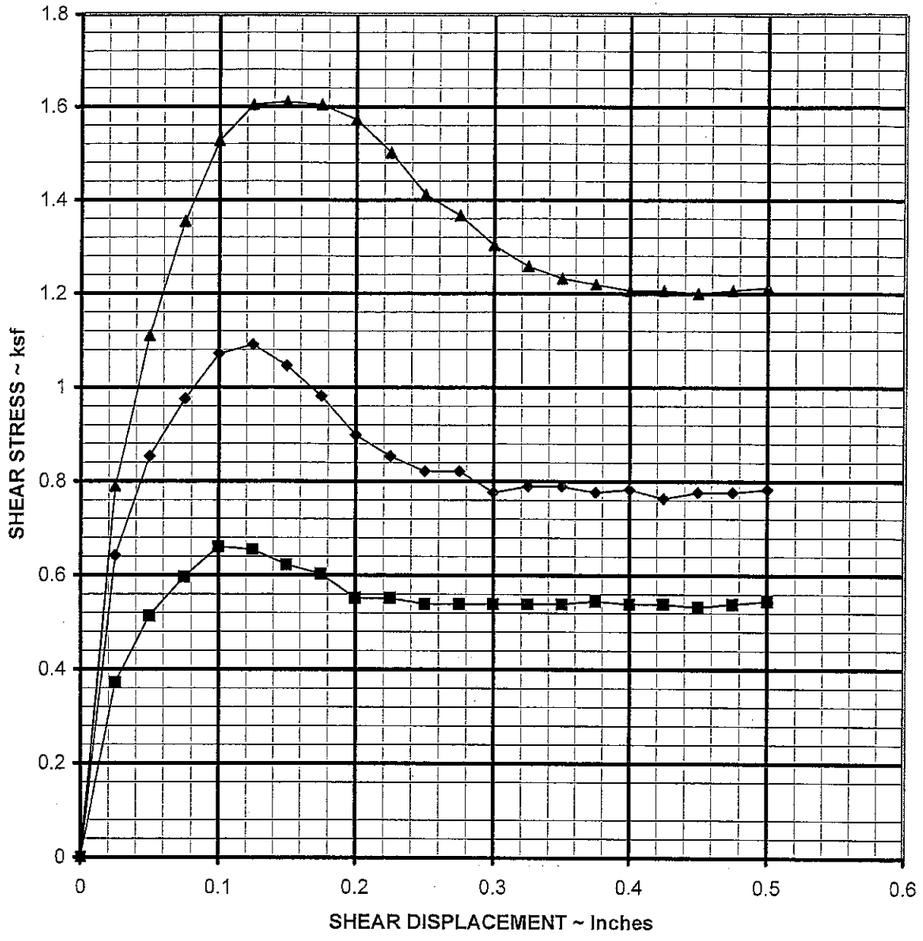
CASING BLOWS PER FOOT	SAMPLE NO.	PEN.	REC.	DEPTH @ BOT	SAMPLER BLOWS PER 6" 0-6	6-12	12-18	18-24	DEPTH	STRATA & TEST DATA
OPEN HOLE	9D	24"	0"	42.0'	5	13	21	26		~ DENSE ~ GRAY SAND AND SILT, TRACE GRAVEL, SOME CLAY OCCASIONAL COBBLES (TILL)
	10D	23"	23"	47.0'	27	27	30	50/5"		~ VERY DENSE ~
									51.0'	
	11D	23"	23"	52.0'	30	48	42	50/5"		BROWN SAND AND SILT, SOME GRAVEL (TILL) WITH OCCASIONAL COBBLES ~ VERY DENSE ~
									56.0'	
	12D	24"	17"	57.0'	34	35	30	30		BROWN SILTY FINE SAND WITH SILT AND CLAY SEAMS ~ VERY DENSE ~
									60.0'	
▼	13D	11"	10"	61.0'	50	50/5"			61.0'	BROWN FINE SAND, TRACE SILT ~ VERY DENSE ~
										BOTTOM OF EXPLORATION AT 61.0' NOT REFUSAL
										NOTE : 1.) TOP 2'+/- FROZEN

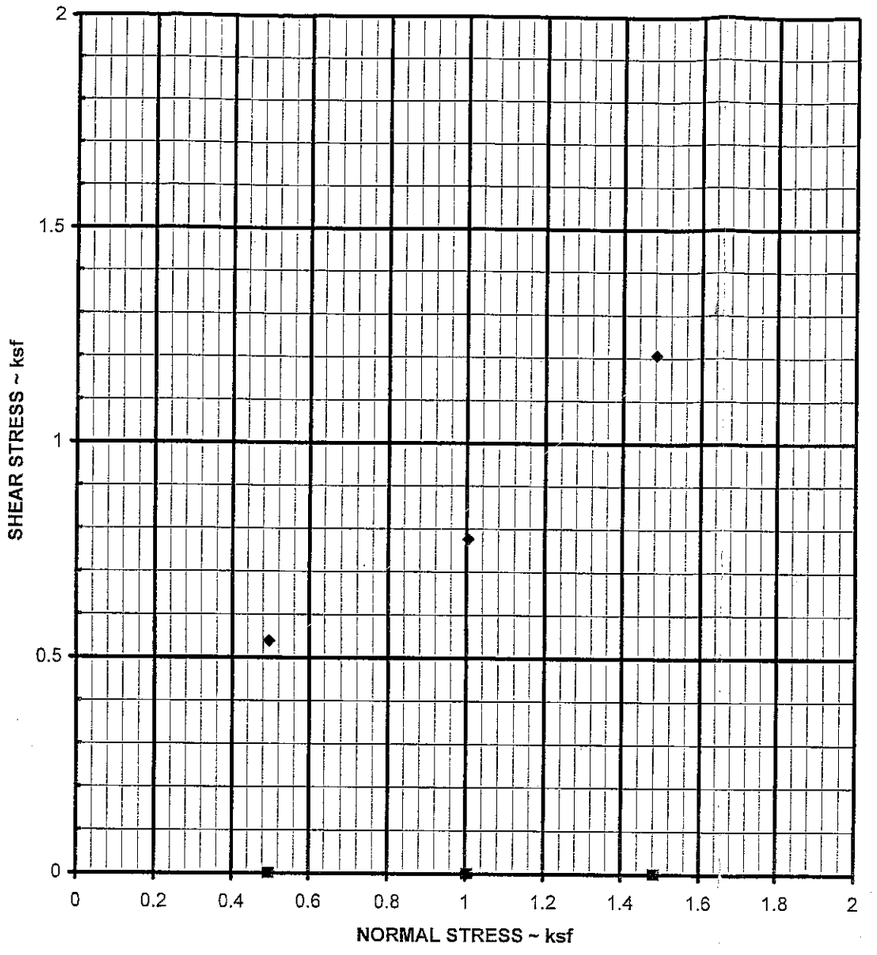
SAMPLES:
D = SPLIT SPOON
C = 3" SHELBY TUBE
U = 3.5" SHELBY TUBE

SOIL CLASSIFIED BY:
[ ] DRILLER - VISUALLY
[X] SOIL TECH. - VISUALLY
[X] LABORATORY TEST

REMARKS:
STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL.

BORING NO.: B-205





DIRECT SHEAR - A.S.T.M. D3080

PLOT	RUN NO.	SOURCE	SWC SAMPLE NO.	CONFINING PRESSURE (ksf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
■	1	B201 5D	1809B	0.5	10.9	126.2
◆	2	B201 5D	1809B	1.0	10.9	126.2
▲	3	B201 5D	1809B	1.5	10.9	126.2

RESIDUAL ANGLE = 34 Degrees
COHESIVE INTERCEPT = 0.15 KSF

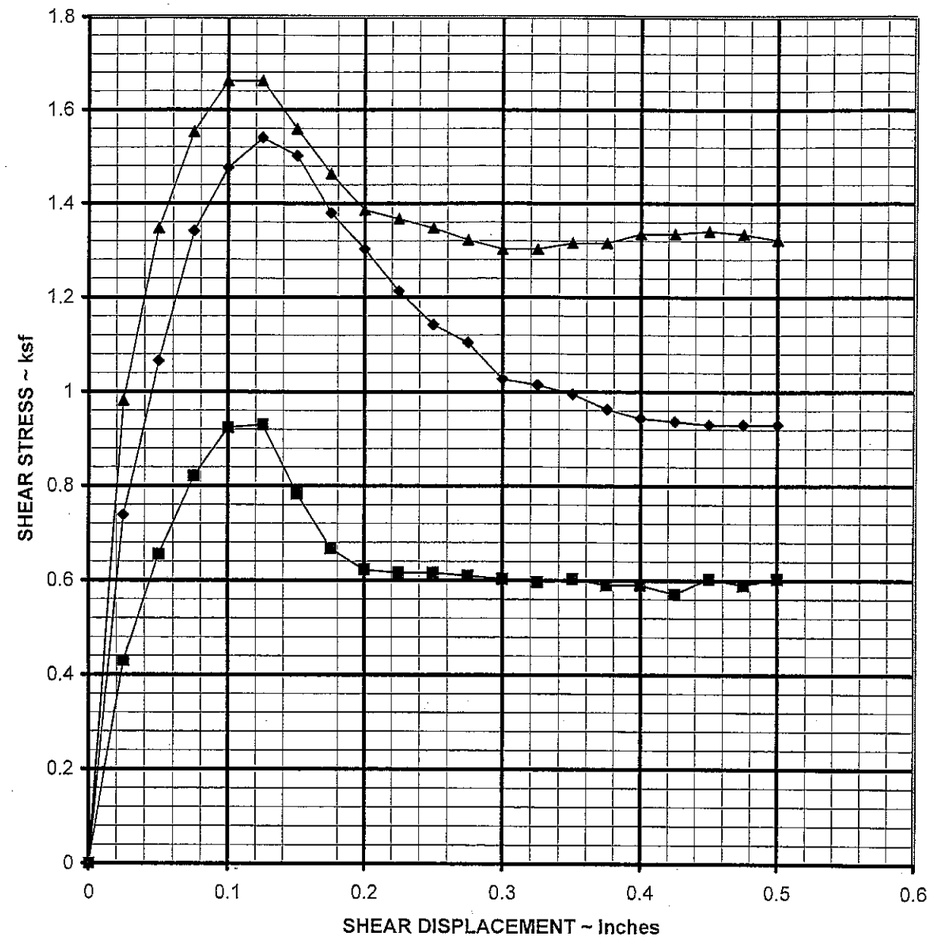
S.W.COLE ENGINEERING, INC.

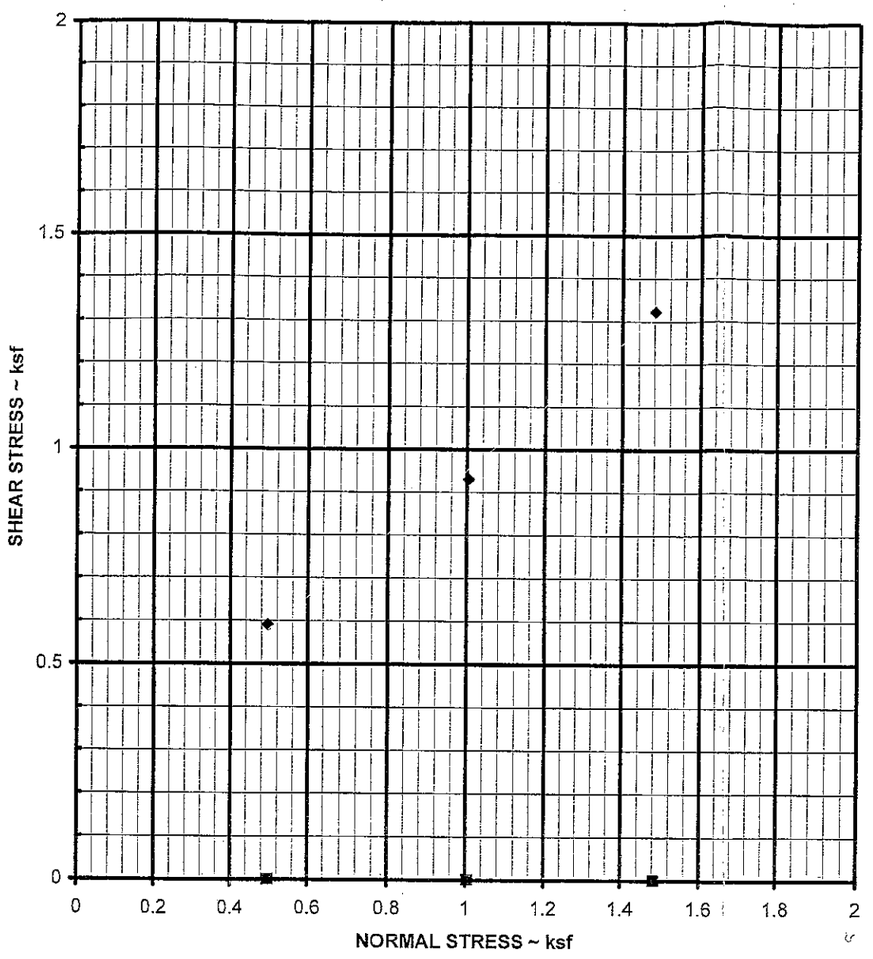
MAINE MEDICAL CENTER

PROPOSED CONGRESS ST. PARKING GARAGE

B201 5D 25'-27'
S-1809B

JOB NO. 02-0067.1
DATE: 3/10/2004 SCALE AS SHOWN





DIRECT SHEAR - A.S.T.M. D3080

PLOT	RUN NO.	SOURCE	SWC SAMPLE NO.	CONFINING PRESSURE (ksf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
■	1	B201 10D	1810B	0.5	11.3	134.8
◆	2	B201 10D	1810B	1.0	11.3	134.8
▲	3	B201 10D	1810B	1.5	11.3	134.8

RESIDUAL ANGLE = 36 Degrees
COHESIVE INTERCEPT = 0.20 KSF

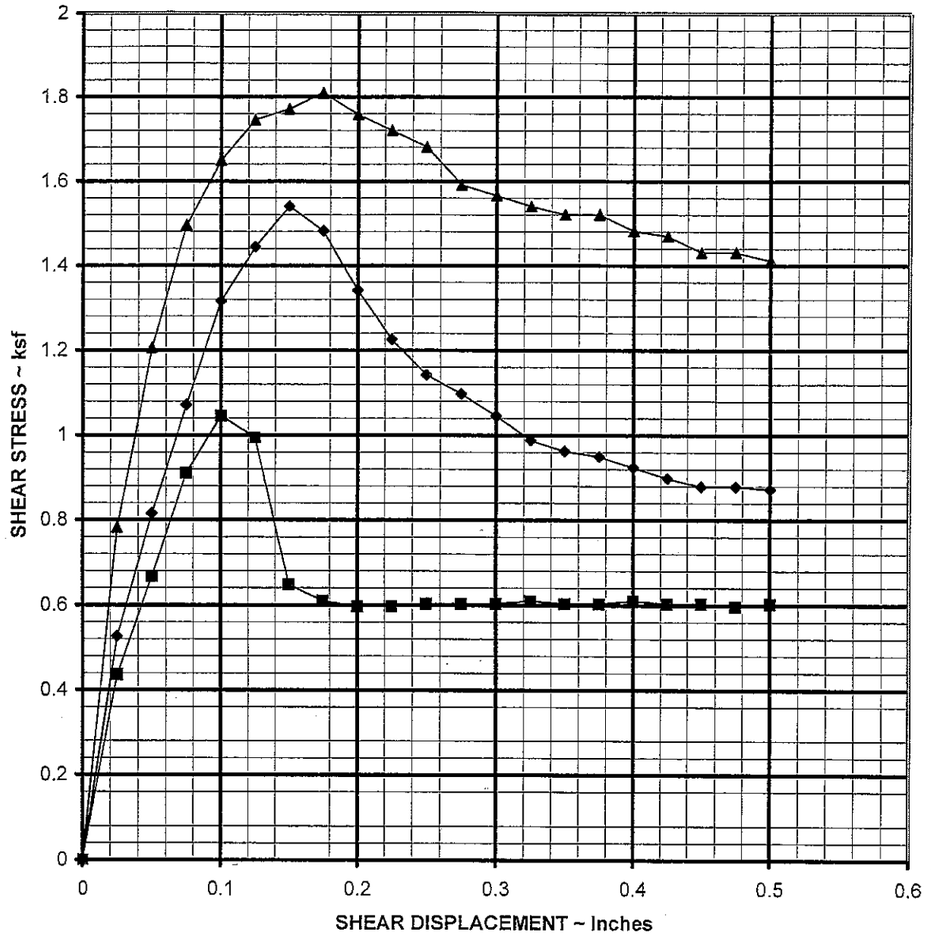
S.W.COLE ENGINEERING, INC.

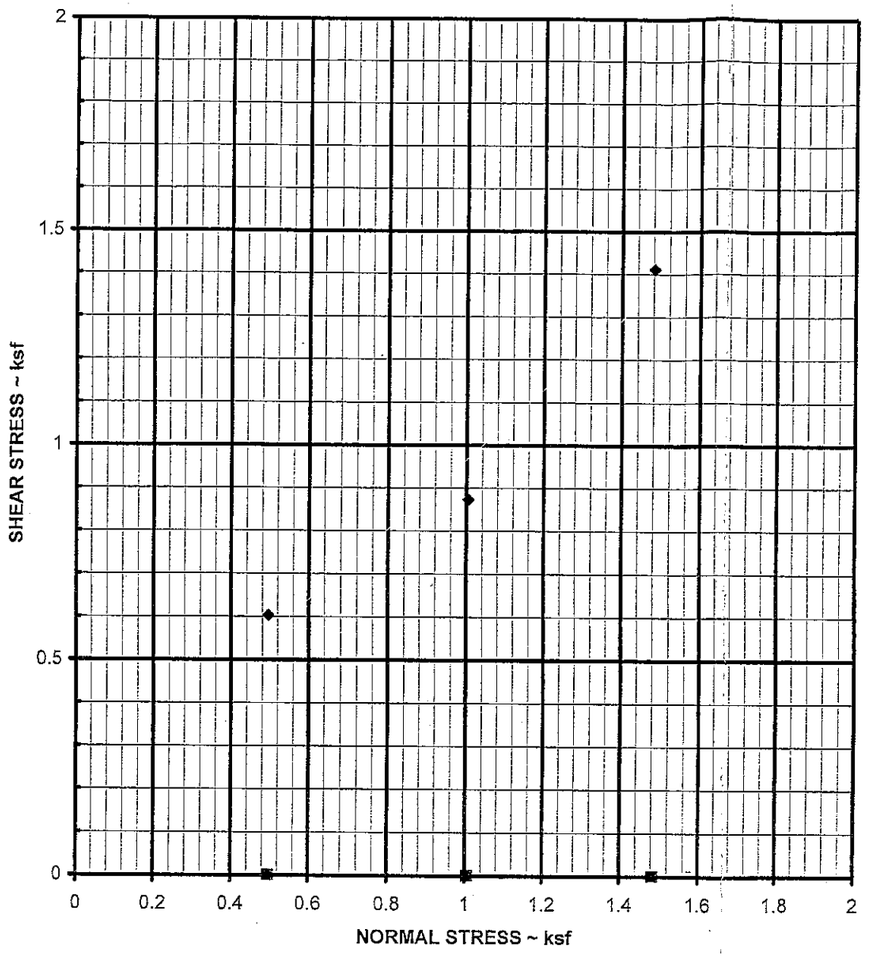
MAINE MEDICAL CENTER

PROPOSED CONGRESS ST. PARKING GARAGE

B201 10D (50'-52')
S-1810B

JOB NO. 02-0067.1
DATE: 3/10/2004 SCALE AS SHOWN





DIRECT SHEAR - A.S.T.M. D3080

PLOT	RUN NO.	SOURCE	SWC SAMPLE NO.	CONFINING PRESSURE (ksf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)
■	1	B201 15D	1811B	0.5	8.5	138.2
◆	2	B201 15D	1811B	1.0	8.5	138.2
▲	3	B201 15D	1811B	1.5	8.5	138.2

RESIDUAL ANGLE = 37 Degrees
COHESIVE INTERCEPT = 0.15 KSF

S.W.COLE ENGINEERING, INC.

MAINE MEDICAL CENTER

PROPOSED CONGRESS ST. PARKING GARAGE

B201 15D 75'-77'
S-1811B

JOB NO. 02-0067.1
DATE: 3/10/2004 SCALE AS SHOWN

SECTION 03 30 00

CAST -IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section and, without limiting the generality thereof, furnish and include the following:

1. The extent of cast-in-place concrete work is shown on drawings and includes (but not by way of limitation) formwork, reinforcing, cast-in-place concrete, accessories, finishing, and casting in of items specified under other Sections of the Specifications or furnished by Owner that are required to be built-in with the concrete.

2. Equipment support pads indicated on mechanical drawings to be installed by the Building Contractor.

3. Cast-in-place retaining walls, exterior slabs on grade and other concrete shown on site drawings.

1.03 RELATED WORK:

A. Metal Fabrications: Section 05 50 00

1. Expansion Anchors - Section 05 12 00

2. Embedded Items - Section 05 50 00

B. Anchor Bolts: Section 05 12 00

C. Joint Sealants: Section 07 92 00

D. Underslab Vapor Retarders/Wall Waterproofing: Division 7

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1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. ACI “Manual of Concrete Practice”.

2. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”.

3. ACI 211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete."

4. ACI 212.3R "Chemical Admixtures for Concrete."

5. ACI 301 "Specifications for Structural Concrete for Buildings."

6. ACI 302.1R "Guide for Concrete Floor and Slab Construction."

7. ACI 304R "Guide for Measuring, Mixing, Transporting and Placing Concrete."

8. ACI 304.2R "Placing Concrete by Pumping Methods."

9. ACI 306 R "Cold Weather Concreting."

10. ACI 308 “Standard Practice for Curing Concrete."

11. ACI 309R "Guide for Consolidation of Concrete."

12. ACI 315 "ACI Detailing Manual."

13. ACI 318 "Building Code Requirements for Reinforced Concrete."

14. ACI 347R "Guide to Formwork for Concrete."

15. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."

16. AISC “Code of Standard Practice for Steel Buildings and Bridges.”

17. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Materials and installed work may require testing and retesting, as directed by the Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

1.05 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

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B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in this Section and Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Reinforcement certified mill reports covering chemical and physical properties and yield strength.

2. Patching products.

3. Non-shrink grout.

4. Curing compounds, where applicable.

5. Admixtures.

6. Expansion/Adhesive Anchors.

H. Shop Drawings:

1. Shop Drawing Preparation: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings is prohibited. Shop drawings created from reproduced Construction Documents will be returned without review. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315, showing bar schedules, stirrup and tie spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete elements. Include supplemental reinforcing and bar supports necessary to support reinforcing steel at proper location within forms or slabs.

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a. Review of the shop drawings will be made for the size and arrangement of reinforcement. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided all items listed prior. **Incomplete submittals will not be reviewed.**

I. Mix designs: Submit all laboratory test reports and materials for each mix design listed within. Prepare mixes by the field experience method and/or trial mixtures per the requirements of chapter 5 of ACI 318. Include the calculation of average strength and standard deviation. Proportioning by water cement ratio method will not be permitted.

J. LEED Documentation: Refer to paragraph 1.06 of this section and Section 01 33 00.

K. Samples: Submit samples of materials as specified and as otherwise requested by Architect, including names, sources and descriptions.

L. Curing Methods: Submit documentation of curing methods to be used for review. Account for anticipated project temperature ranges and conditions in curing methods.

M. Contraction/Construction Joints: Submit plan indicating proposed location of contraction and construction joints in walls and slabs.

N. Test Reports: Test reports shall be submitted to the Owner, Architect and Engineer within 48 hour after completion of each test.

1.06 LEED Requirements

A. Material Recycled Content: Slag or Fly Ash Cement Replacement

1. Blast Furnace Slag: Granulated blast furnace slag conforming to ASTM C989, included in the calculation of water-cementitious materials, and shall be included in the concrete mix. The weight of granulated blast-furnace slag shall be 30 percent of cementitious materials. The slag used in the manufacture of a Type IS or ISM blended hydraulic cement conforming to ASTM C595 shall be included in the calculated percentage.

2. Fly Ash: As an alternate to Blast Furnace Slag, Fly Ash and pozzolan conforming to ASTM C618, included in the calculation of water-cementitious materials, shall be included in the concrete mix. If used the Fly ash shall be included in the percentages prescribed above. The fly ash and pozzolan present in ASTM Type IP or IPM blended cement, conforming to ASTM C595, shall be included in the calculated percentage.

3. Concrete mix designs shall indicate the cement replacement percentages.

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4. Substitution of 4,000 psi concrete for 3,000 psi concrete is not acceptable.

B. Material Recycled Content: Concrete Reinforcing Steel

1. Pre-consumer recycled content: 50%

2. The sum of the post industrial and post consumer recycled content: 25%

3. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

C. Local/Regional Materials: Ready-mix concrete supplier shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the building site.

D. Local/Regional Materials: Concrete reinforcement fabrication shall be located within 500 miles of the project location. Submit documentation of manufacturing locations and origins of materials for products manufactured within 500 miles of the building site.

E. Low emitting adhesives and sealants: Provide water-based, biodegradable form coating with maximum VOC content of 55 grams/liter. Provide cut sheet and/or material safety data sheet for form coating with VOC levels highlighted.

F. Waste Management:

1. Before concrete pours, designate locations or uses for excess concrete. Options include the following:

a. Additional paving.

b. Post footing anchorage.

c. Swale, riprap reinforcing.

d. Flowable fill.

e. Footing bottom, retaining wall footing ballast.

f. Storm structure covers.

g. Underground utility pipe kickers.

h. Storm pipe flared end section.

i. Toe wash protection, and shoulder and toe outfall restraints for temporary erosion pipes.

2. Before concrete pours, designate a location for cleaning out concrete trucks. Options include the following:

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a. Company-owned site for that purpose (meeting environmental standards).

b. On-site area to be paved later in Project.

3. Collect waste reinforcing steel and place in designated area for recycling.

PART 2 - PRODUCTS

2.01 FORM MATERIALS:

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with piece bearing legible inspection trademark.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. Provide welded wire fabric in flat sheets.

C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use plastic, wire bar type supports or concrete block supports complying with CRSI recommendations, unless otherwise specified. Wood, clay brick and other unspecified devices are not acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

2.03 CONCRETE MATERIALS:

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A. Single-Source Supplier: Ready-mix concrete shall be from one supplier unless specific written approval is received from the Structural Engineer.

B. Portland Cement: ASTM C 150, Type I or Type II, unless otherwise approved Use one brand of cement throughout project, unless otherwise acceptable to Architect.

C. Normal Weight Aggregates: ASTM C 33. Provide from a single source for exposed concrete. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, or ochre which can cause stains on exposed concrete surfaces.

D. Light Weight Aggregates: ASTM C 330.

E. Water: Potable.

F. Air-Entraining Admixture: ASTM C 260.

G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G containing not more than 1% chloride ions.

H. Fiber reinforcement shall be Type III Synthetic Virgin Homopolymer Polypropylene Fibers conforming to ASTM C1116. Fiber reinforcing shall be added and distributed prior to incorporation of Super Plasticizer.

I. Normal range water reducing admixture: ASTM C 494 Type A containing no calcium chloride.

J. Accelerating Admixture: ASTM C 494, Type C or E.

K. Corrosion Inhibiting Admixture. Accepted products include:

1. “DCI S Corrosion Inhibitor,” by W.R. Grace & Co. Construction Products

2. Pre-approved equivalent.

L. Blast Furnace Slag: ASTM C989

M. Fly Ash: ASTM C618, Class C or F

N. Calcium Chloride is not permitted.

2.04 RELATED MATERIALS:

A. Underslab Vapor Retarder: Provide vapor retarder over prepared sub base. Refer to architectural drawings, geotechnical report and/or division 7 specifications for additional requirements and vapor retarder location.

B. Non-Shrink Cement-based Grout: Provide grout consisting of pre-measured, prepackaged materials supplied by the manufacturer requiring only the addition of water. Manufacturer's instructions must be printed on the outside of each bag.

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1. Non-shrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%) and a maximum of 0.3% expansion in the hardened state when tested in accordance with CRD-C-621.

2. Compressive strength: A minimum 28 day compressive strength of 5000 psi when tested in accordance with ASTM C-109.

3. Setting time: A minimum initial set time of 60 minutes when tested in accordance with ASTM C-191.

4. Composition: Shall not contain metallic particles or expansive cement.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171.

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

E. Liquid Membrane-Forming Curing Compound: Liquid type membrane forming curing compound complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Curing compound shall not impair bonding of any material, including floor finishes, to be applied directly to the concrete. Demonstrate the non-impairment prior to use.

F. Preformed Expansion Joint Formers:

1. Bituminous Fiber Type, ASTM D 1751.

2. Felt Void, Poly-Styrene Cap with removable top as manufactured by SUPERIOR.

G. Slab Joint Filler: Multi-component polyurethane sealant (self-leveling type).

H. Waterstops shall be Bentonite/Butyl Rubberbased product. Use in conjunction with manufacturer's approved mastic. Acceptable products include:

1. "Waterstop Rx," by American Colloid Co.

2. "Mirastop," by Carlisle Coatings & Waterproofing.

3. "Adeka Ultra Seal MC-2010," by Asahi Denka Koeyo, Kik MN.

2.05 PROPORTIONING AND DESIGN OF MIXES:

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A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318. Use material, including all admixtures, proposed for use on the project. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Submit written reports to Architect of each proposed mix for each class of concrete. Do not begin concrete production until mixes have been reviewed by Architect.

C. Proportion design mixes to provide concrete with the following properties:

1. Footings and foundation walls

   a. Strength: 3000 psi at 28 days.

   b. Aggregate: 3/4"

   c. W/C Ratio: 0.54 maximum

   d. Entrained Air: 6% +/- 1.5%

   e. Slump: 4" maximum

2. Interior Slabs on grade and elevated slabs:

   a. Strength: 3000 psi at 28 days

   b. Aggregate: 3/4" minimum, 1 1/2" maximum.

   c. W/C Ratio: 0.54 maximum

   d. Entrapped Air only (no entrainment), 2.5% +/- 1%

   e. Slump: 4” maximum

3. Exterior Slabs and all other exposed Site Concrete not specified elsewhere:

   a. Strength: 4500 psi at 28 days

   b. Aggregate: 3/4"

   c. W/C Ratio: 0.45 maximum

   d. Entrained Air: 6% +/- 1.5%

   e. Slump: 4" maximum

4. Add air entraining admixture at manufacturers prescribed rate to result in concrete at point of placement having the above noted air contents.

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5. Add corrosion inhibiting admixture at manufacturers prescribed rate.

6. Additional slump may be achieved by the addition of a mid-range or high-range water reducing admixture. Maximum slump after the addition of admixture shall be 6 or 8 inches for mid-range or high range water reducing admixtures, respectively.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Structural Engineer before using in work.

1. Water may be added at the project only if the maximum specified slump and design mix maximum water/cement ratio is not exceeded.

2. Additional dosages of superplastisizer should be used when delays occur and required slump has not been maintained. A maximum of two additional dosages will be permitted per ACI 212.3R recommendations.

2.06 CONCRETE MIXING:

A. Job-Site Mixing will not be permitted.

B. Ready-Mix Concrete: Must comply with the requirements of ASTM C 94, and as herein specified. Provide batch ticket for each batch discharged and used in work, indicating project name, mix type, mix time and quantity.

1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required by Structural Engineer.

2. When the air temperature is between 85 degrees F. and 90 degrees F., reduce the mixing and delivery time from 1 1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F., reduce the mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMS:

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Design, construct, erect, maintain, and remove forms for cast-in-place concrete work in compliance with ACI 347.

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C. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

D. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

E. Vertical dovetail slots may be required for masonry tie installation. Coordinate dovetail slot spacing and location with division 4 specifications and Architectural drawings.

F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, dovetail slots, reglets, recesses, and the like to prevent swelling and for easy removal.

G. Provide temporary openings where interior area of formwork is inaccessible for clean out, for inspection before concrete placement and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

H. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

I. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties for concrete surfaces to be exposed to view in the final condition so portion remaining within concrete after removal is 1" (minimum) inside concrete.

2. Form ties shall not leave holes larger than 1" diameter in concrete surface. Repair holes left by form ties after removal of formwork.

J. Provision for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

K. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement as required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT:

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A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

1. Subgrade tolerance shall conform to a tolerance of +0/-1 1/2". Base tolerance (fine grading) for slabs shall conform to a tolerance of +0”/-3/4” in. Confirm compliance of above tolerances with surveyed measurements taken at 20 ft. intervals in each direction.

2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

3. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

4. Place reinforcement to obtain specified coverage for concrete protection within tolerances of ACI-318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

5. Install welded wire fabric in flat sheets in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 JOINTS:

A. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect. Submit plan indicating proposed location of construction joints for review prior to beginning work.

1. Provide keyways at least 1-1/2" deep in construction joints in walls, and slabs; bulkheads reviewed by the Engineer, designed for this purpose may be used for slabs.

2. Roughened surfaces shall be used between walls and footings unless shown otherwise on the drawings. The footing surface shall be roughened to at least an amplitude of 1/4" for the width of the wall before placing the wall concrete.

3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.

4. Joints in slabs on grade shall be located and detailed as indicated on the drawings. If saw-cut joints are required, the early-entry dry-cut process shall be used. Refer to ACI 302, section 8.3.12.

3.04 INSTALLATION OF EMBEDDED ITEMS:

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A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto. Notify other trades to permit installation of their work. Templates to be utilized for setting of anchorage devices shall be constructed in a manner to allow mechanical consolidation of concrete. "Wet Setting" of embedded items into plastic concrete will not be permitted without special permission from the Engineer.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface.

C. Provide PVC sleeves where pipes and/or conduit pass through exterior concrete or slabs. Sleeves or penetrations shall not be placed through footings, piers, pedestals, drop caps, columns or pilasters unless specifically noted.

D. Tolerances: Tolerances for Anchor Bolts/Rods, other embedded items and bearing surfaces shall meet the requirement set forth in the latest edition of the American Institute of Steel Construction "Code of Standard Practice for Steel Buildings and Bridges," and ACI 117. The more stringent criteria from these documents shall apply.

3.05 INSTALLATION OF GROUT

A. Place grout for base plates in accordance with manufacturer's recommendations.

B. Grout below setting plates as soon as practicable to facilitate erection of steel and prior to removal of temporary bracing and guys. If leveling bolts or shims are used for erection grout shall be installed prior to addition of any column load.

C. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

3.06 PREPARATION OF FORM SURFACES:

A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating material manufacturer's directions. Do not allow excess form coating to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.07 CONCRETE PLACEMENT:

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A. Preplacement Review: Footing bottoms are subject to review by the Geotechnical Engineer. Reinforcement and all concrete preparation work shall be subject to review by the Structural Engineer. Verify that reinforcing, ducts, anchors, seats, plates and other items cast into concrete are placed and securely held. Notify Engineer/Project Special Inspector 48 hours prior to scheduled placement and obtain approval or waiver of review prior to placement. Be sure that all debris and foreign matter is removed from forms.

B. Concrete shall be placed in the presence of an approved testing agency.

C. General: Comply with ACI 304, and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

2. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

3. Conveying equipment shall be approved and shall be of a size and design such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or work day. Conveying equipment and operations shall conform to the following additional requirements:

a. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An arrangement shall be used at the discharge end to prevent apparent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.

b. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long, and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.

c. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete.

d. Concrete shall not be conveyed through pipe made of aluminum alloy. Standby equipment shall be provided on the site.

e. Tined rakes are prohibited as a means of conveying fiber reinforced concrete.

4. Do not use reinforcement as bases for runways for concrete conveying equipment or other construction loads.

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D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment. Hand-spading, rodding or tamping as the sole means for the consolidation of concrete will only be permitted with special permission from the Engineer. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

2. Use vibrators designed to operate with vibratory equipment submerged in concrete, maintaining a speed of not less than 8000 impulses per minute and of sufficient amplitude to consolidate the concrete effectively. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine, generally at points 18 inches maximum apart. Place vibrators to rapidly penetrate placed layer and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion maintain the duration of vibration for the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix, generally from 5 to 15 seconds. A spare vibrator shall be kept on the job site during all concrete placing operation.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete using internal vibrators during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations. Do not sprinkle water on plastic surface.

3. Maintain reinforcing in proper position during concrete placement operations.

4. Slab thicknesses indicated on the drawings are minimums. Provide sufficient concrete to account for structure deflection, subgrade fluctuations, and to obtain the specified slab elevation at the flatness and levelness indicated here within.

5. Finish: See “Monolithic Slab Finishes” in this specification for slab finish requirements.

F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

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1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degrees C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C), and not more than 80 degrees F (27degrees C) at point of placement.

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 and other materials containing antifreeze agents or chemical accelerators.

4. All temporary heat, form insulation, insulated blankets, coverings, hay or other equipment and materials necessary to protect the concrete work from physical damage caused by frost , freezing action, or low temperature shall be provided prior to start of placing operations.

5. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed between 50 and 70 degrees F.

G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Wet forms thoroughly before placing concrete.

4. Do not use retarding admixtures without the written acceptance by the Architect.

3.08 FINISH OF FORMED SURFACES:

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This concrete surface shall have texture imparted by form facing material, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.

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B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This as-cast concrete surface shall be obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment. Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

1. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

D. Related Unformed Surfaces: At tops of walls and grade beams, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off, smooth and finish with a texture matching adjacent unformed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.09 FLOOR FLATNESS AND LEVELNESS

A. Floor flatness/levelness tolerances: Tolerances for various floor uses shall conform to the requirements set forth in ACI 117 and ACI 302 for “flat” floor profile.

1. Minimum Test Area Flatness/Levelness: F_F30/F_L20

2. Minimum Local F Number: F_F15/F_L10

B. Levelness criteria shall be applied to slabs-on-grade only.

C. Contractor shall measure floor finish within 72 hours after slab finishing and provide corrective measures for finishes not within tolerance. Corrective procedures shall be reviewed by the Architect prior to implementation.

3.10 MONOLITHIC SLAB FINISHES:

A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds, and as otherwise indicated.

1. After placing slabs, plane surface to a tolerance not exceeding 1/2 in. in 10 ft. when tested with a 10-ft. straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms or rakes.

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B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, and as otherwise indicated.

C. Trowel Finish: Apply trowel finish to monolithic slab surfaces indicated, including slab surfaces to be covered with carpet, resilient flooring, paint or other thin-film finish coating system.

D. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

E. Slab finishes for floor coverings not indicated or exposed to view in the final condition shall be coordinated with the Architect prior to slab placement.

F. Slab Joints: Where indicated, sawn slab contraction joints shall be "soft cut", immediately after concrete surface is firm enough not to be torn or damaged by the blade.

3.11 CONCRETE CURING AND PROTECTION:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 308 as herein specified.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified unless noted otherwise. Curing shall commence as soon as concrete surfaces are sufficiently hard as to withstand surface damage. Slabs-on-grade shall be cured by moist curing methods.

C. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Protection From Mechanical Injury: During the curing period and duration of construction, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete.

3.12 REMOVAL OF FORMS:

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

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B. Formwork supporting weight of concrete, such as joints, slabs and other structural elements, may not be removed in fewer than 14 days or until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

C. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and support.

3.13 REUSE OF FORMS:

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and latency, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.14 MISCELLANEOUS CONCRETE ITEMS:

A. Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

3.15 CONCRETE SURFACE REPAIRS:

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to the Architect.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush coat the area to be patched with approved bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, form tie holes, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, and other projections on surface and stains and other discolorations that cannot be removed by cleaning.

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3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION:

A. Project Special Inspector shall verify reinforcement, including foundation reinforcement and slab reinforcement (WWF or reinforcing bar). Agent shall verify WWF or reinforcement has been chair/placed with proper clearances.

B. The Owner shall employ a Testing Laboratory to inspect, sample and test the materials and the production of concrete and to submit test reports. Concrete testing shall be performed by technicians certified by the Maine Concrete Technician Certification Board and/or ACI Concrete Field Testing Technician Grade I.

C. Concrete shall be sampled and tested for quality control during placement. Quality control testing shall include the following, unless otherwise directed by the Architect.

D. See Submittals section for report requirements.

E. Sampling Fresh Concrete: ASTM C 172.

1. Slump: ASTM C143; One test for each set of compressive strength test specimens. Sample shall be taken from middle third of the load per ASTM C172. A slump test must be run prior to the incorporation of the CFP fibers per recommendations of ACI 544. A slump test must be run prior to and following the addition of a water reducer (superplasticizer) per recommendations of ACI 301.

2. Air Content: ASTM C231 "Pressure method for normal weight concrete." one test for each set of compressive strength specimens measured at point of discharge.

3. Concrete Temperature: Per ASTM C-1064; One test each time a set of compression test specimens are made.

4. Compression Test Specimen: ASTM C31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

a. An insulated Cure Box for specimen curing shall be supplied by Testing Agency for initial curing as defined in ACI C31.

b. Means of heating or cooling the Cure Box shall be provided by the Inspection Agency if required in order to maintain a temperature between 60 and 80 degrees F. Contractor shall provide an electrical source to the Testing Agency when required for temperature control.

c. A maximum-minimum thermometer shall be provided in the Cure Box by the Testing Agency to record the temperature range of the Cure Box during specimen curing. The Testing Agency shall record the maximum/minimum temperature of the Cure Box when transferring the specimens to the laboratory.

d. Test Specimens shall be moist cured.

e. Refer to ACI C31 for additional requirements for Test Specimens.

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5. Compressive Strength Tests: ASTM C39; one set for each 50 cu. yds. or fraction thereof, of each concrete class placed in any one day or for each 4,000 sq. ft. of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 specimen retained in reserve for later testing if required.

6. Pumped concrete shall be tested at point of discharge per ACI 301.

F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods, as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

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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. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units (CMUs).
2. Face brick.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.

B. Related Sections include the following:

1. Division 07 Section "Bituminous Dampproofing" for dampproofing applied to cavity face of backup wythes of cavity walls.
2. Division 07 Section "Penetration Firestopping" for firestopping at openings in masonry walls.
3. Division 07 Section "Joint Sealants" for sealing control and expansion joints in unit masonry.

C. Products installed, but not furnished, under this Section include the following:

1. Architectural precast concrete units, furnished under Division 03 Section "Precast Architectural Concrete."
2. Hollow-metal frames in unit masonry openings, furnished under Division 08 Section "Hollow Metal Doors and Frames."
3. Hollow-metal frames in unit masonry openings, furnished under Division 14 Section "Hydraulic Elevators."

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

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

B. Shop Drawings: For the following:

1. 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.

C. Samples for Selection: For the following:

1. Face brick, in the form of straps of five or more bricks.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project**.** Label Samples to indicate types and amounts of pigments used.

D. 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.

E. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include material 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.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

G. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Provide documentation from manufacturer to verify source location for each type of masonry unit used in the project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this Section with minimum 5 years experience.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.

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, through one source from a 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 a single manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

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 48 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 window opening in exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
c. 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).
d. Include wood studs, sheathing, air barrier, cavity insulation, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

2. Clean exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. 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 Conferences: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. At least 7 days prior to starting CMU masonry, conduct a meeting to review detailed requirements for mortar and grout mixes and to determine procedures for satisfactory construction and curing operations. Review requirements of submittals, status of coordinating work, and availability of materials. Review requirements tenting and heating. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with masonry construction to attend, including the following:

a. Contractor's superintendent.
b. Masonry foreman.
c. Architect.

2. At least 7 days prior to starting veneer masonry, conduct a meeting to review detailed requirements for mortar mixes and to determine procedures for satisfactory construction operations. Review requirements of submittals, status of coordinating work, and availability of materials. Review requirements tenting and heating. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with masonry construction to attend, including the following:

a. Contractor's superintendent.
b. Masonry foreman.
c. Architect.

1.6 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 lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 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 and hold cover securely in place.
2. Where 1 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 3 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 (4 to 0 deg C): Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C).
b. 32 to 25 deg F (0 to -4 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Heat masonry units to 40 deg F (4 deg C). 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 (-4 to -7 deg C): Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C).
d. 20 deg F (-7 deg C) and Below: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F (4 and 49 deg C). Heat grout materials to

produce grout temperatures between 40 and 120 deg F (4 and 49 deg C). Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40 deg F (4 deg C).

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 (4 to 0 deg C): Cover masonry with insulating blankets for 48 hours after construction.
   b. 32 deg F (0 deg C) and Below: Provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 72 hours after construction.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) 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 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not uses units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

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.

C. Provide products that are manufactured within 500 miles of project site.

2.3 CONCRETE MASONRY UNITS (CMUs)

A. Shapes: Provide shapes indicated and as follows:

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. Concrete Masonry Units: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Weight Classification: Normal weight.
3. Curing: Allow masonry units to cure 28 days to permit drying shrinkage before laying.
4. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
5. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.4 MASONRY LINTELS

A. Masonry Lintels: Built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.5 BRICK

A. General: Provide shapes indicated and as follows:

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.

B. Face Brick: ASTM C 216, Grade SW, Type FBS (extruded).

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 8000 psi.
2. Initial Rate of Absorption: Less than 18 g/30 sq. in. per minute when tested per ASTM C 67.

3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in the applied finish when viewed from 10 feet.
5. Size (Actual Dimensions): 3-5/8 inches wide wide by 2-1/4 inches high by 7-5/8 inches long.
6. Application: Use where brick is exposed, unless otherwise indicated.
7. Products:

    a. Old Port Blend by Morin Brick Company; contact: Paul LaChance; phone: (207) 784-9375.

2.6 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. Blue Circle Cement, Inc.: Eaglebond High Strength Type "S".
2. Ciment Quebec, Inc.: Portland and Lime / Type S.
3. 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. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Available Products:

    a. Davis Colors; True Tone Mortar Colors.
    b. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.

F. Aggregate for Mortar: ASTM C 144.

G. Aggregate for Grout: ASTM C 404.

H. Water: Potable.

2.7 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.

1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter for interior walls and W2.8 or 0.188-inch diameter for exterior walls.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
5. Wire Size for Veneer Ties: W1.7 or 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.

D. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2. Available Products:

a. Duro-wall; D/A 370 Ladur-eye.
b. Hohmann & Barnard; Lox-All Adjustable Eye-Wire, #170.
c. Wire-Bond; Series 900, Composite Hook and Eye.

2.8 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.

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. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.

2. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

D. Partition Top anchors: 0.097-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 Strap 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) Heckmann Building Products Inc.; No. 77 Wing-Nut Pos-I-Tie.

2.9 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.

2.10 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

a. Available Products:

1) Advanced Building Products Inc.; Copper Fabric Flashing.
2) AFCO Products Inc.; Copper Fabric.
3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
7) York Manufacturing, Inc.; York Copper Fabric Flashing.

b. Asphalt-Free copper-laminated flashing products will also be acceptable. Similar to Multi-Flash 500 Series by York.

B. 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.

2.11 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. Holmann & Barnard: #NS – Closed Cell Neoprene.
2. Wire Bond: 3000 Horizontal.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. 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) Wire-Bond; Cell Vent.

D. Cavity Drainage Material: 2-inch- thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

1. Available Products:

a. Mortar Net by Mortar Net USA, LTD.; Model MN10-2.
b. Mortar Break by Advanced Building Products; Mortar Break II.

E. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.

1. Available Products:

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.

F. Grout Screen: Monofilament screen fabricated from high-strength, non-corrosive, polypropylene polymers.

1. Available Products: Subject to compliance with requirements, grout screen materials that may be incorporated into the Work include, but are not limited to, the following:

a. AA3260; AA Wire Products.
b. Dur-O-Stop; Dur-O-Wal, Inc.
c. MGS; Hohmann and Barnard.

2.12 CAVITY-WALL INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin. Provide 4 by 8 foot sheets with shiplapped edges, thickness as indicated on the drawings.

1. Available Products:

a. Dow Chemical Company; Cavitymate SC.

2. Application: At wood framed backup walls with Pos-I-Ties.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, closed-cell product extruded with an integral skin , tongue and groove edges.

1. Thickness: As indicated.
2. Products:

a. Amofoam ; Amoco.
b. Formular; Owens Corning.

c. Styrofoam; Dow Chemical Company.

3. Application: At CMU backup walls with multi-wythe anchors.

C. Adhesive: Type recommended by insulation board manufacturer for application indicated.

2.13 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.

2.14 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. Limit cementitious materials in mortar to portland cement and lime.

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.

D. Pigmented Mortar: Use select and proportion pigments with other ingredients to produce color required.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample. Allow for 2 bag mix.
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. 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 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. 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.

F. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:

1. 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.

2. 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.
3. 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.
4. For exposed 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. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. 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.
6. 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.
7. 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.

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 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. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. 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.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. At non-fire rated partitions, 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 Division 07 Section "Fire-Resistive Joint Systems."

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units 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. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch. Tool joints smooth on surfaces exposed to fire or smoke.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is necessary, remove mortar and replace.

3.5 CAVITY WALLS

A. Bond wythes of cavity walls together using the following method:

1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.

a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.

B. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

1. Install the specified cavity drainage material in thickness to fill the cavity above flashings as work progresses.

C. Coat cavity face of backup wythe to comply with Division 07 Section "Bituminous Dampproofing."

D. Installing Cavity-Wall Insulation: At sheathing, 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. At masonry backup wall, 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”.

3.6 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., unless noted otherwise.
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.

a. Reinforcement above is 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.

D. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

E. Provide continuous horizontal-joint reinforcement in block veneer. Space reinforcement not more than 16-inches o.c., starting reinforcement on top of first block course.

3.7 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 cavity insulation.
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.

B. Anchor masonry veneers to structural masonry back-up wythe with wire ties designed to engage pintle-eye assembly incorporated in joint reinforcement.

1. Use individual adjustable metal ties installed in horizontal joints to bond wythes together. Provide ties shown, 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 36 inches, around perimeter.
2. Engage pintles form ties into eyes connected to joint reinforcement.

3.8 CONTROL AND EXPANSION JOINTS

A. 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.

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."

3.9 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.

3.10 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. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Fold flashing back over itself 1/2 inch to form hem.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building wrap, lapping at least 4 inches.
4. At lintels and shelf angles, extend flashing a minimum of 8 inches into masonry at each end. At heads and sills, extend flashing 8 inches at ends and turn up not less than 2 inches to form end dams.
5. Extend flashing 3/8 inch beyond face of veneer and fold down to form drip.

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 Part 2 "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.

3.11 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 temporary 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.

3.12 FIRESTOPPING

A. Firestopping: Refer to Division 07 Section “Penetration Firestopping” for installation requirements. Provide firestopping, as part of the work of this section, at the top of fire-rated masonry walls between top of partition and underside of structure above, both for new and existing conditions. Where gypsum wallboard is installed at the top of rated existing masonry walls, the firestopping will be provided by others.

1. Bearing walls, not subject to vertical movement, may be grouted solid between top of wall and underside of structure, in lieu of firestopping.

3.13 INSTALLATION OF PRECAST CONCRETE UNITS

A. 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 as units are being permanently connected.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
2. Unless otherwise indicated, maintain uniform joint widths of 3/8 inch.

3.14 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. Inspections: [**Level 1**] [**Level 2**] special inspections according to the "International Building Code."

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports:

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.

E. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

F. Mortar Test (Property Specification): For each mix provided, per ASTM C 780. Test mortar for compressive strength.

G. Grout Test (Compressive Strength): For each mix provided, per ASTM C 1019.

3.15 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: 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 brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20 Revised, and manufacturer's printed instructions.
6. 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.

3.16 MASONRY WASTE DISPOSAL

A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.

B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

1.03 RELATED WORK

1. Section 05 50 00 - Metal Fabrications

1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with latest provisions of the following, except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges", Latest Edition.

a. The provisions of Section 10, "Architecturally Exposed Structural Steel", apply to exposed steel elements for this project. In addition, exposed welds shall be ground to provide smooth surface.

b. Exclude the word "structural" in reference to the "Design Drawings" in section 3.1 of the Code.

2. AISC "Specification for Structural Steel Buildings", including "Commentary" and Supplements issued thereto.

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3. AISC *"Specifications for Structural Joints using ASTM A 325 or A 490 Bolts"* approved by the Research Council on Structural Connections of the Engineering Foundation.

4. AISC 341, "Seismic Provisions for Steel Buildings".

5. AWS D1.1 - "Structural Welding Code" - Steel.

6. AWS D1.3 - "Structural Welding Code" - Sheet Steel.

7. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."

8. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

1. Provide certification that welders to be employed in work have satisfactorily passed AWS D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the field.

2. If re-certification of welders is required, retesting will be the Contractor's responsibility.

C. Fabricator Qualifications: Fabricator must be a member of the American Institute of Steel Construction (AISC), be certified for SBD – Conventional Steel Building Structures, STD – Standard for Steel Building Structures. Fabricator shall be certified at time of bidding and for duration of project.

1.05 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. **INCOMPLETE SUBMITTALS WILL NOT BE REVIEWED.**

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.

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F. **Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.**

G. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.

2. High-strength bolts (each type), including nuts and washers.

3. Structural steel primer paint (where applicable).

4. Structural steel top coat paint (where applicable). (Refer to Section 09 90 00.)

5. AWS D1.1 Welder certifications.

6. Expansion/Adhesive Anchors (coordinate with section 03 30 00).

H. Fabricator's Quality Control Procedures: Fabricator shall submit their written procedural and quality control manuals, and evidence of periodic auditing of fabrication practices by an approved inspection Agency.

I. Fabricator's Certificate of Compliance: At completion of fabrication, fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the construction documents.

J. Shop Drawings:

1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.

a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings

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indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.

2. Connection Design: Connections for all beam, column, braced frame, and moment connections not tabulated in the AISC "Manual of Steel Construction" (ASD or LRFD) have been designed and detailed in the drawings. Alternate connection design shall be allowed only with prior approval of the Structural Engineer. If such approval is granted, all redesigned connections shall be designed by the fabricator's engineer, registered in the State of Maine. Calculations for redesigned connections shall be signed and sealed.

3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.

K. LEED Documentation: Refer to paragraph 1.07 of this section and Section 01 33 00.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site at such intervals to insure uninterrupted progress of work.

B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Steel materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

1.07 LEED Requirements:

A. Material Recycled Content: Structural Steel shall be meet the following minimum recycled content:

1. Pre-consumer recycled content: 50%

2. The sum of the post industrial and post consumer recycled content: 25%

3. Submit invoices and documentation from manufacturer of the amounts of post-consumer and post-industrial recycled content by weight for products with specified recycled content.

B. Waste Management: Collect offcuts and scrap and place in designated areas for recycling.

PART 2 - PRODUCTS

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2.01 MATERIALS:

A. Structural Steel Shapes, Plates and Bars (U.N.O): ASTM A 36 minimum, higher strength steel is acceptable.

B. Structural Steel Hot Rolled Wide Flange Shapes: ASTM A 992 Grade 50 (ASTM A572 Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997)

C. Steel Tube: ASTM A 500, Grade B, Fy = 46 ksi.

D. Steel Pipe: ASTM A 53, Grade B.

E. Anchor Bolts: ASTM F1554, Grade 36 weldable steel, unless noted otherwise on drawings. Anchor rods that are to be exposed to weather, located in unheated enclosures, or in contact with pressure treated lumber shall be hot dipped galvanized. All anchor bolts shall be headed or double nutted. "J" or "L" type anchor bolts are not permitted.

F. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.

G. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325 or ASTM A490. Refer to drawings for diameter.

2. Direct tension indicator washers or bolts may be used at Contractor's option.

3. Provide hot-dipped galvanized fasteners at relieving angles.

H. Steel Shear Studs: Headed type manufactured from steel conforming to ASTM A108 Grade C1015 by KSM or Nelson. Refer to Drawings for diameter and length.

I. Electrodes for Welding:

1. Minimum 70 ksi electrodes. Filler material shall meet the grouping requirements per AWS D1.1 Table 3.1 for matching strength of connected materials.

2. All filler metal used welding shall meet the following Charpy V-Notch (CVN) requirements.

a. 20 ft-lb at 0 degrees Fahrenheit unless noted otherwise.

b. 20 ft-lb at -20 degrees Fahrenheit and 40 ft-lb at 70 degrees Fahrenheit at all complete joint penetration (CJP) groove welds.

J. Structural Steel Coatings shall be as specified in the Structural Steel Coatings section of this specification, and as specified in Division 9.

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K. Steel Coatings for Exterior Exposed Steel: Except where indicated to be primed and painted, Hot Dipped Galvanized per ASTM A123/A123M (latest edition). Galvanizing shall be applied in a manner to provide Class C faying surfaces for slip critical connections. See Structural Steel Coatings section for additional requirements for galvanizing and painting.

L. Non Shrink Cement-Based Grout: See Section 03 30 00

M. Drilled Anchors: Expansion and adhesive by HILTI, SIMPSON or POWERS/RAWL as indicated on the drawings.

2.02 FABRICATION:

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.

B. Connections: Weld or bolt shop connections, as indicated.

1. Provide field bolted connections, except where welded connections or other connections are indicated.

2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

C. High-Strength Bolted Connection: Install high-strength threaded fasteners in accordance with AISC “Specification for Structural Joints using ASTM A 325 or A 490 Bolts”. Unless otherwise indicated, all bolted connections are to be tightened to the snug tight condition as defined by AISC.

D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

G. Fabricator, Erector and General Contractor shall coordinate safety requirements for the project, in accordance with OSHA Part 1926. Provide all necessary pieces and

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fabrications as required to safely erect and access the structure for the duration of project construction.

H. Camber, if any, is indicated on the drawings. Camber indicated is the required camber at time of erection. Contractor shall survey camber prior to placing metal deck.

2.03 STRUCTURAL STEEL COATINGS

A. Coordinate coating requirements with the Architect, and with Division 9 of the specifications.

B. To the greatest extent possible, structural steel coatings shall be shop applied.

C. Galvanizing, priming and painting for structural steel permanently exposed to view shall meet the requirements of Section 10 of the Code of Standard Practice, “Architecturally Exposed Structural Steel”.

D. Provide venting/drainage holes in closed tubular members to be hot-dipped galvanized. Holes shall be provided in a location hidden from view in the final condition and in a manner that will not reduce the strength of the member. Hole locations shall be clearly indicated on the Shop Drawings and are subject to review by the Architect.

E. Follow manufacturer’s installation and safety instructions when applying coatings. Adhere to recoat time recommendations set forth by manufacturer.

F. General: Shop priming of structural steel is not required for heated, interior steel not exposed to view unless noted otherwise.

G. Steel which is to receive spray-on fireproofing shall not to be primed or painted, unless specified by the Architect.

H. Brick masonry loose lintels and relieving angle assemblies, including fasteners, shall be hot dipped galvanized, unless noted otherwise on the Architectural Drawings

I. Unheated structural steel to be enclosed with architectural finishes, including but not by limitation, canopy members and/or roof pop-up members shall be primed with rust inhibitive alkyd primer, Tnemec Series 349 unless noted otherwise. Follow manufacturer’s instructions for surface preparation and application. Substitution shall be equal to the above specified products, and shall be submitted for review.

J. Steel Embedded in Concrete/Below Grade: Steel which is embedded in concrete, below grade/slab level, or as otherwise indicated on the drawings, shall be field painted with cold-applied asphalt emulsion complying with ASTM D 1187. Paint embedded areas only. Do not paint surfaces which are to be welded until welding is complete.

K. Field Touch-up: Touch-up all paint and galvanizing damage, including but not by limitation, damage caused during shipping, erection, construction damage, and field welded steel. See Division 9 specifications for additional requirements.

PART 3 - EXECUTION

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3.01 ERECTION:

A. General: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

B. Erection Procedures: Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

C. Surveys: Employ a Registered Land Surveyor to verify elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.

D. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.

E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

2. Welding to anchor bolts for corrective measures is strictly prohibited without prior written approval from the Engineer.

F. Setting Plates and Base Plates:

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Refer to division 3 of the project Specifications for anchor bolt installation requirements in concrete.

2. Clean concrete bearing surfaces of bond-reducing materials. Clean bottom surface of setting and bearing plates.

3. Set loose and attached base plates for structural members on wedges or other adjusting devices.

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4. Pack non-shrink grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.

G. Concrete slabs that are part of elevated floors framing systems shall achieve 28-day design strength prior to the application of any superimposed loads such as curtain walls, masonry veneer, mechanical equipment and stairs. Additional testing beyond that specified in division 3 required to verify the concrete strength prior to application of superimposed loads shall be done at the Contractor's expense.

H. When installing expansion bolts or adhesive anchors, the contractor shall take measures to avoid drilling or cutting any existing reinforcement or damaging adjacent concrete. Holes shall be blown clean with compressed air and/or cleaned per manufacturer's recommendations prior to the installation of anchors.

I. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.

2. Align, adjust, level and plumb members of complete frame in to the tolerances indicated in the AISC Code of Standard Practice and in accordance with OSHA regulations.

3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.

4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

5. Splice members only where indicated and accepted on shop drawings.

6. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

J. Coat columns, base plates, and brace elements encased in concrete and/or below grade with cold-applied asphalt emulsion. Coordinate coating with concrete work.

K. Erection bolts: Remove erection bolts. On exposed welded construction fill holes with plug welds and grind smooth at exposed surface.

L. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as accepted by the Engineer of Record. Finish gas-cut sections equal to a sheared appearance when permitted.

M. Coating Damage: Touch up shop applied paint or galvanizing whenever damaged or bare. See "Coatings" sections for additional requirements.

N. Field Cut Beam Web Penetrations:

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1. Field cut beam web penetrations are not permitted without written approval from the Structural Engineer.

2. Gas cutting torches are not permissible for cutting beam web penetrations without written approval from the Structural Engineer.

3. Beams with field cut beam web penetrations may require reinforcement, subject to the evaluation by the Structural Engineer.

4. The evaluation of field cut web penetrations by the Structural Engineers for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be compensated by the General Contractor or Design-Build Subcontractor.

5. The cost of executing field cut web penetrations and the associated beam reinforcement for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be paid for by the General Contractor or Design-Build Subcontractor.

6. Field cut beam web penetrations may not be permitted in certain locations, subject to the evaluation by the Structural Engineer.

O. Welders shall have current evidence of passing and maintaining the AWS D1.1 Qualifications test available in the field.

P. Welding electrodes, welding process, minimum preheat and interpass temperatures shall be in accordance with AISC and AWS specifications. Any structural steel damaged in welding shall be replaced.

3.02 QUALITY CONTROL:

A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.

1. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.

B. Testing: Owner shall engage an Independent Testing Agency to inspect all high-strength bolted and welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.

1. Testing agency shall conduct tests and state in each report which specific connections were examined or tested, whether the connections comply with requirements, and specifically state any deviations therefrom.

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2. Contractor shall provide access for testing agency to places where structural steel work is being fabricated, produced or erected so that required inspection and testing can be accomplished. Testing agency may inspect structural steel at plant before shipment. The Engineer, however, reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

C. Inspection Requirements (to be performed by the Independent Testing Agency):

1. Bolted Connections: Inspect all bolted connections in accordance with procedures outlined in the AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts.

2. Snug Tight Bolted Connections:

a. The inspector shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.

b. If the inspector does not monitor the installation of bolts, he shall visually inspect the connection to determine that all plies of connected material have been drawn together and conduct tests on a sampling connection bolts to determine if they have been tightened to the snug tight condition. The test sample shall consist of 10% of the bolts in the connection, but not less than two bolts, selected at random. If more than 10% of the tested bolts fail the initial inspection, the engineer reserves the right to increase the number of bolts tested.

3. Slip Critical Bolted Connections:

a. The inspector shall monitor the calibration of torquing equipment and the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.

b. If the inspector does not monitor the calibration or installation procedures, he shall test all bolts in the affected connection using a manual torque wrench to assure that the required pretension has been reached.

4. Field Welded Connections: inspect and test during fabrication of structural steel assemblies, and during erection of structural steel all welded connections in accordance with procedures outline in AWS D1.1. Record types and location of defects found in work. Record work required and performed to correct deficiencies.

a. Certify welders and conduct inspections and tests as required. Submit welder certifications to Engineer of Record. Perform visual inspection of all welds. Primary and secondary welds, including fillet welds, full penetration welds, and deck puddle welds, applied in the field and/or shop, shall be visually inspected.

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b. Welds deemed questionable by visual inspection shall receive non-destructive testing. In addition, all partial and full penetration welds, and any other welds indicated on the drawings are to receive non-destructive testing. Non-destructive testing methods include the following:

1. Radiographic Inspection (RT): ASTM E 94 and ASTM E 142; minimum quality level "2-2T".

2. Ultrasonic Inspection (UT): ASTM E 164.

3. Magnetic Particle (MT) inspection procedures may be utilized at the inspectors discretion in addition to RT or UT inspection. MT procedures shall not replace RT or UT procedures without permission from the Structural Engineer.

c. All welds deemed unacceptable shall be repaired and retested at the Contractor's expense.

D. Inspector shall verify that all ferrules are removed when applicable and that metal deck is free of debris prior to concrete placement.

E. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.

F. Nonconforming Work: Contractor shall be responsible for correcting deficiencies in structural steel work which inspections laboratory test reports have indicated to be not in compliance with requirements. Additional tests and/or surveys shall be performed, at the Contractor's expense, as may be necessary to show compliance of corrected work. Any costs associated with the Engineer's review and disposition of faulty works shall be borne by the Contractor.

END OF SECTION

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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. This Section includes the following:
1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Elevator machine beams.
4. Support angles for elevator door sills.
5. Loose bearing and leveling plates.
6. Metal ladder for elevator pit.
7. Metal bollards.
8. Understory fence by Alternate #5

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
3. Division 05 Section "Structural Steel Framing."
4. Division 05 Section "Pipe and Tube Railings."
5. Division 06 Section "Rough Carpentry" for metal framing anchors.

1.3 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: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation 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.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. LEED Submittal:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material with associated documentation.

C. Shop Drawings: Show fabrication and installation details for metal fabrications.

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.

D. Welding certificates.

E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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 METALS, GENERAL

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: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

C. Fabrication of Steel Products: Provide products extracted, processed and manufactured within 500 miles of home

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

D. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.4 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, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. 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. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3.

G. Lag Bolts: ASME B18.2.1.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1.

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; 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, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, 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 Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.5 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.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 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.; Aquapon Zinc-Rich Primer 97-670.
e. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
f. Tnemec Company, Inc.; Tneme-Zinc 90-97.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

1. Available Products:

a. Sealmastic, Type 1; W. R. Meadows
b. Hydrocide 600; Sonneborn Building Products.
c. Karnak 100 AF; Karnac Chemical Corp.

F. 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.

1. Available Products:

a. Five Star Grout by Five Star Products, Inc.
b. Masterflow 928 Grout by Master Builders Technologies.
c. Sonogrout 10K by Sonneborn.

d. 14K Hy Flow by Sonneborn.

G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 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 true to line and level 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 where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be 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.

1. 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.

2.7 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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Furnish inserts if units are installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.8 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. 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.

2.9 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.

2.10 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 not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

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. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

2.12 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.14 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. 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 metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, 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. 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 bolts, 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 will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a 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.

3.3 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 grout.

1. Use nonshrink grout, nonmetallic, in concealed and exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Fill bollards solidly with concrete, mounding top surface to shed water.

3.5 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.

END OF SECTION

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. This Section includes the following:

1. Alternating Tread Stair.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of loads and stresses within limits and under conditions specified in ICC's International Building Code.

1.4 SUBMITTALS

A. Product Data: For metal stairs and the following:

1. Alternating tread stair.

B. LEED Submittal:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material with associated documentation.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 COORDINATION

A. 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.

B. 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 ALTERNATING TREAD STAIR

A. Provide alternating tread stairs where shown on the drawings. Stairs shall conform to layout and dimensions indicated in drawings.

B. Available Manufacturer: Lapeyre Stair, 220 Laitram Lane, LA 70123 (800 535-7631).

1. Stair units shall be a complete assembly including stair, hand rails, platforms, supports, mounting and fastening devices.
2. Treads: Capable of withstanding a concentrated load of 1000 lbs. Without deformation.
3. Handrails: Capable of withstanding a concentrated load of 200 lbs. Applied in any direction and at any point on the rail.
4. Finish: Safety yellow powder coat.

2.2 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.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.3 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, 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 Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

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.

3.2 INSTALLING ALTERNATING TREAD STAIR

A. Install in strict accordance with stair manufacturers printed installation instructions.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

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. This Section includes the following:

1. Steel pipe and tube railings.
2. Steel gates.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

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. 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.

3. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..

b. Uniform load of 25 lbf/sq. ft. applied horizontally.
c. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation 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.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Grout, anchoring cement, and paint products.

B. LEED Submittal:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material with associated documentation.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. 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.

D. Welding certificates.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION AND SCHEDULING

A. 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.

B. 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.

PART 2 - PRODUCTS

2.1 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.

C. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

D. Fabrication of Steel Products: Provide products extracted, processed and manufactured within 500 miles of home

2.2 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

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.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Castings: Either gray or malleable iron, unless otherwise indicated.

1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

2.3 FASTENERS

A. General: Provide the following:

1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

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. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide cast-in-place, chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum 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.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Available Products:

    a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
    b. Carboline Company; Carbozinc 621.
    c. ICI Devoe Coatings; Catha-Coat 313.
    d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
    e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
    f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
    g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. 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.

1. Available Products:

    a. Five Star Grout by Five Star Products, Inc.
    b. Masterflow 928 Grout by Master Builders Technologies.
    c. Sonogrout 10K by Sonneborn.
    d. 14K Hy Flow by Sonneborn.

2.5 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. Assemble railings in the shop 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. 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 work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections, unless otherwise indicated.

H. 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.

I. Form changes in direction as follows:

1. As detailed.

J. 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.

K. Close exposed ends of railing members with prefabricated end fittings.

L. 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.

M. 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 fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. 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.

O. 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 steel plate forming bottom closure.

2.6 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.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.7 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. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

F. 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 railings:

1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 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. Do not apply primer to galvanized surfaces.
2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

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 have been 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 have been 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. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

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 Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been 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. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material or attached to post with set screws.

D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.

E. 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.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. 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 wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.7 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 same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 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.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, and without limiting the generality thereof furnish and install the following:

1. Wood framing, including joists, rafters, outriggers, scab-ons, headers, stringers, posts, studs, plates, truss bracing and similar members.

2. Wood grounds, nailers, blocking and sleepers.

3. Wood furring.

4. Floor, roof and wall sheathing.

5. Miscellaneous carpentry as indicated or required and not specified under other Sections of the Specifications.

6. Fasteners and accessories as indicated and required for rough carpentry.

7. Treated wood as specified.

B. Related Work Specified Elsewhere:

1. Finish carpentry: Section 06 20 00.

2. Prefabricated wood trusses: Section 06 17 53.

3. Gypsum wall sheathing: Section 09 29 00.

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4. Underlayments: Division 7

5. Furnishing and installing of doors and frames: Division 8.

1.03 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the latest edition of the following except where more stringent requirements are shown or specified:

1. International Building Code, 2003 Edition – International Code Council

2. ANSI/AF&PA (American Forest & Paper Association) – NDS National Design Specification for Wood Construction – Latest Edition

3. AHA (American Hardboard Association) A135.4 – Basic Hardboard.

4. ALSC (American Lumber Standards Committee) – Softwood Lumber Standards.

5. ANSI A208.1 – Mat-Formed Wood Particleboard.

6. APA (American Plywood Association).

7. AWPA (American Wood Preservers Association) C1-All Timber Products – Preservative Treatment by Pressure Process.

8. AWPA (American Wood Preservers Association) C20-Structural Lumber Fire Retardant Treatment by Pressure Process.

9. NELMA (New England Lumber Manufacturer's Association).

10. NLGA (National Lumber Grades Authority)

11. NIST (National Institute of Standards and Technology, U. S. Department of Commerce [DOC])

12. NFPA (National Forest Products Association)

13. NFPA (National Fire Protection Association)

14. SPIB (Southern Pine Inspection Bureau).

15. WCLIB (West Coast Lumber Inspection Bureau).

16. WWPA (Western Wood Products Association).

17. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

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B. Lumber shall be supplied in accordance with the following agencies:

1. Lumber Grading Agency: Certified by NLGA for structural framing.

2. Sheathing Grading Agency: Certified by APA or ICBO approved certification agency. For non-APA rated plywood, provide ICC ES Evaluation report.

3. Grading stamp shall be on lumber and plywood.

4. Submit manufacturer's certificate certifying that products meet or exceed specified requirements.

C. Panelized/Prefabrication plant inspection: Prefabrication plant is subject to plant inspection completed by the Engineer-of-Record or an approved Third Party Inspection Agency. Inspections shall be performed at the Contractor's expense. Plant inspection does not relieve the Contractor of the obligation to perform work in accordance with the Construction Documents or from implementing their own shop and field quality control program. Mock-up panel shall be provided in order to demonstrate and allow Engineer-of-Record or approved Third Party Inspection Agency to review fabrication product.

1.04 SUBMITTALS

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in sections Division 1have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

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G. Panelized Construction Fabrication and Erection Drawings: If the contractor elects to use prefabricated wall, floor and/or roof panels, the panels shall meet or exceed the framing indicated in the construction documents, and applicable code requirements. Review by Engineer is for structural elements only; dimensional review is specifically excluded for this scope. Contractor remains solely responsible for proper fit-up of panels. Fee for a single structural review cycle will be $2,400. Architect review fee is not included. **Review by the Architect and Engineer of panel shop drawings shall be performed at the contractor's expense.** Shop drawings shall include the following:

1. Framing layouts for all panel assemblies as required to completely describe panel construction.

2. Identification of all framing, sheathing and connection components

3. Sheathing Lap Details

4. Fastener patterns, spacing, length, diameter and finish for all prefabricated panels including framing and sheathing conditions.

5. Field fastening and construction details

6. Alternate framing connections that vary from design documents shall be submitted to the Engineer for approval prior to preparation of the shop drawings. Acceptance of alternate framing connections is subject to Engineer's review based on to project condition. Contractor is responsible to provide as-detailed conditions if alternate connections are not accepted.

H. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards). Product data shall include ICC/ICBO Evaluation Reports indicating conformance to standards specified here within.

1. Engineered Wood Products

2. Pressure Treated Lumber

3. Sheathing

4. Samples of Exposed to View Wood Members: Submit two samples, 6 inches long, illustrating wood grain, stain, and finish.

5. Hangers, Hardware and Accessories

6. LEED Documentation: Refer to paragraph 1.05 of this section and Section 01 33 00.

1.05 LEED Requirements:

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A. Regional materials, regional manufacture: Use dimensioned lumber manufactured within 500 mile radius of project.

B. Regional materials, regional extraction: Use dimensioned lumber extracted, harvested or recovered within 500 mile radius of project.

C. Waste Management:

1. Schedule ordering of lumber and materials to minimize field cuts. Submit schedule as part of LEED documentation.

2. Collect offcuts and scrap and place in designated areas for salvage use.

3. Utilized offcut as blocking or for short length members.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Protect materials from warping or other distortion by stacking to resist movement.

B. Follow manufacturer's recommendations for storage of Engineered Wood Products and connection hardware.

PART 2 - PRODUCTS

2.01 LUMBER MATERIALS

A. Lumber, General: Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

B. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.

2. Provide seasoned lumber with 19% maximum moisture content at time of dressing.

C. For structural framing (4" and wider and from 2" to 4" thick), provide the following grade and species:

1. Spruce-Pine-Fir (SPF) #1/2 or better, NLGA Graded, unless noted otherwise on Structural Drawings, Minimum Design Stresses:

a. Fb: 875 psi

b. Ft: 450 psi

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c. Fv: 135 psi

d. Fc⊥: 425 psi

e. Fc: 1,150 psi

f. E: 1,400,000 psi

2. Douglas Fir Larch (North) #1/2 or better, NLGA Graded, where indicated on drawings. Minimum Design Stresses:

a. Fb: 850 psi

b. Ft: 500 psi

c. Fv: 180 psi

d. Fc⊥: 625 psi

e. Fc: 1,400 psi

f. E: 1,600,000 psi

3. Pressure treated lumber: Southern Yellow Pine #2 or better. Minimum Design Stresses:

a. Fb: 1,300 psi

b. Ft: 775 psi

c. Fv: 175 psi

d. Fc⊥: 565 psi

e. Fc: 1,650 psi

f. E: 1,400,000 psi

4. See structural drawings for grades and bending stress at specific locations.

D. Miscellaneous Lumber: Provide wood for support or attachment of other work including cant strips, bucks, nails, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

1. Moisture content: 19% maximum for lumber items not specified to receive wood preservative treatment.

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2. Grade: Construction Grade light framing size lumber of any species or board size lumber as required. Provide construction grade boards (NELMA, NLGA or WCLB) or No.2 boards (SPIB, NLGA, NELMA, or WWPA).

2.02 SHEATHING LOCATIONS

A. Roof Sheathing: NIST/DOC PS-1 or PS-2 rated, Exposure 1, 5/8 inch thick, 48 x 96 inch sized sheets, square edges, unless noted. Provide H-clips per the manufacturer's recommendations.

B. Floor Sheathing: NIST/DOC PS-1 or PS-2 rated, Exposure 1, 3/4 inch thick, 48 x 96 inch sized sheets, tongue and groove.

C. Wall Sheathing: NIST/DOC PS-1 or PS-2 rated, Exposure 1, 1/2 inch thick, 48 x 96 inch sized sheets, square edges.

D. Wall Sheathing at Shear Walls: DOC PS-1 or PS-2 rated, Exposure 1, 48 x 96 inch sheets, square edges, unless noted otherwise.

E. Thicknesses indicated are nominal.

F. Sheathing shall be stamped with grading agency stamp

G. Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels where required per Code requirements. Paint as required by electrical code.

2.03 ENGINEERED WOOD PRODUCTS

A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which, current model code research or evaluation reports exist that evidence compliance with building code in effect for Project. Provide depths and widths as indicated.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2. Source and Species: Unless otherwise indicated, lumber sources in Engineered Wood Products shall be of single source and species.

3. Adhesives shall be exterior type, complying with ASTM D2559.

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4. Substitutions: Substitutions of Engineered Wood Products other than those specified will be permitted only with written certification from the manufacturer that the substituted items "meets or exceeds" all properties of the specified product, including engineering, serviceability, aesthetic and durability characteristics. Substitutions shall not be made without written approval of the Architect and Engineer.

B. Laminated-Veneer Lumber (LVL): Lumber manufactured by laminating wood veneers in a continuous press using an exterior-type adhesive complying with ASTM D *2559* to produce members with grain of veneers parallel to their lengths and complying with the following requirements:

Boise Cascade	F_b = 3080 psi, E = $2.0x10^6$
I-Level:	F_b = 2600 psi, E = $1.9x10^6$

C. Parallel-Strand Lumber (PSL): Lumber manufactured by laying up wood strands using an exterior-type adhesive complying with ASTM D 2559, and cured under pressure to produce members with grain of strands parallel to their lengths and complying with the following requirements:

I-Level :	Fc_{ll} = 2,900 psi, , F_b=2900 psi, E = 2.0 x 10^6

D. I-Joists: Meet manufacturer's standards for all properties and stiffness, for I-Joist series indicated.

Boise Cascade:	BCI Series, as indicated on the drawings
I-Level:	TJI Series, as indicated on the drawings

E. Laminated Strand Lumber (LSL): Lumber manufactured by laying up wood strands using an exterior-type adhesive complying with ASTM D 2559, and cured under pressure to produce members with laminations of strands parallel to their lengths and complying with the following requirements:

I-Level:	F_b = 1,700 psi, E = 1.3 x 10^6 (depths to 8 5/8")
	F_b=1,700 psi, E = 1.7 x 10^6 (depth 9 1/4" and up)

2.04 ACCESSORIES

A. Fasteners, Anchors, Connectors and Hardware:

1. Fasteners (for wood framing): Nail fasteners shall meet requirements of ASTM F1667. Unless noted otherwise, nails referenced on drawings are to be Common Nails with dimensions as follows:

a. 6d: 2" long by 0.113" diameter shank with 0.266" diameter head

b. 8d: 2 1/2" long by 0.131" diameter shank with 0.281" diameter head

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c. 10d: 3” long by 0.148” diameter shank with 0.312” diameter head

d. 12d: 3 1/4" long by 0.148” diameter shank with 0.312” diameter head

e. 16d: 3 1/2" long by 0.162” diameter shank with 0.344” diameter head

f. 20d: 4” long by 0.192” diameter shank with 0.406” diameter head

g. 30d: 4 1/2" long by 0.207” diameter shank with 0.438” diameter head

2. Anchor Bolts: ASTM A307 headed and SSTB Anchor Bolts by Simpson StrongTie, unless noted otherwise. “J” or “L” type anchor bolts shall not be substituted.

3. Screw fasteners (where indicated on drawings or required to install connection hardware):

a. SD & SDS Screws by Simpson Strong Tie

b. RSS Screws by GRK Fasteners, (800) 263-0463

c. Timberlok Screws by Fasten Master.

d. Wood Screws: ANSI/ASME Standard B18.6.1

4. Lag Screws: ANSI/ASME Standard B18.2.1. Provide lead hole per NDS Chapter 11.

5. Through Bolts: ANSI/ASME Standard B18.2.1:

a. Holes for through bolts shall be a minimum of 1/32nd and a maximum of 1/16th larger than bolt diameter.

b. A standard cut washer shall be provided between the wood and bolt head, and wood and nut, unless noted otherwise.

B. Structural Framing Connectors, Hardware or Joist Hangers: As indicated on the drawings or sized to suit framing conditions, manufactured by Simpson or approved alternate.

1. Unless noted, fill all nail holes to achieve manufacturer’s maximum reaction rating.

2. Use nail diameter and length as specified by connector manufacturer. Substitutions of pneumatic nails or “joist hanger” (non standard length) nails shall not be made without written authorization of the Engineer.

C. Construction Adhesive: APA AFG-01, approved for use with type of construction panel indicated by both adhesive and panel manufacturer.

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D. ALL ANCHORS, CONNECTORS AND FASTENERS IN CONTACT WITH PRESSURE TREATED LUMBER, AND/OR AT EXTERIOR EXPOSURE SHALL HAVE COATINGS AS FOLLOWS, UNLESS NOTED OTHERWISE:

1. Anchor Bolts/Bolts/Lag Bolts: Hot Dipped Galvanized, ASTM A123

2. Connection Hardware, unless otherwise noted: Simpson Strongtie Stainless Steel Z-Max (G185 per ASTM A653) or Hot Dipped Galvanized (HDG, ASTM A123). Use hot dipped galvanized fasteners, ASTM A153 with these hangers.

3. Nails and Fasteners, unless otherwise noted: Hot Dipped Galvanized, ASTM A153. Use type 304 or 316 stainless steel fasteners with stainless hardware.

4. Proprietary coatings used in conjunction with pressure treated fastener coatings will be permitted with written permission from the Architect and Engineer.

2.05 FACTORY WOOD TREATMENT

A. PRESSURE TREATED LUMBER (P. T.)

1. Wood Preservative (Pressure Treatment): AWPA Treatment, ACQ-C (amine formulated), ACQ-D or CA-B, ammonia free.

2. The use of ACZA and CCA treated lumber is strictly prohibited.

3. Retention:

a. Above Ground Use: ACQ: 0.25 pcf, CA-B: 0.10 pcf

b. Ground Contact Use: ACQ: 0.40 pcf, CA-B: 0.21 pcf.

4. See Section the “Fasteners, Anchors, Connectors and Hardware” portion of this specification for fastener, anchor and hardware requirements for use with pressure treated lumber.

5. Pressure treated lumber shall not contain ammonia unless authorized by the Architect and Engineer. Ammonia content shall be verified with the Pressure Treatment manufacturer.

PART 3 - EXECUTION

3.01 PREFABRICATED CONSTRUCTION REQUIREMENTS (PANELIZED CONSTRUCTION, CONSTRUCTED OFF-SITE)

A. Prefabrication shall not commence until shop drawings have been approved by the Engineer and Architect.

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B. Panels shall meet or exceed the framing designed in the construction documents, and applicable code requirements.

C. Framing shall not be drilled, notched or cut for any reason without prior written approval from the Structural Engineer (ie. passage of wiring, piping).

D. Quality Assurance Requirements:

1. Panelized/Prefabrication plant inspection: Prefabrication plant is subject to plant inspection completed by the Engineer-of-Record or an approved Third Party Inspection Agency prior to shipment to the jobsite. Inspections shall be performed at the Contractor's expense. Plant inspection does not relieve the Contractor of the obligation to perform work in accordance with the Construction Documents or from implementing their own shop and field quality control program.

2. Panel sheathing shall not be covered with air barrier (Typar, Tyvek, Construction Paper, etc) prior to shipment and until visual inspection by Engineer is complete.

3. Wall panels shall be constructed utilizing results of an as-built foundation survey to ensure that wall panels fit up correctly on foundation. Employ a Registered Land Surveyor to determine elevations and locations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to prefabricated wood construction have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.

4. Fasteners into sheathing and framing shall not be overdriven. Head of fastener shall be flush with surface of member being fastened. Maximum indentation tolerance from flush shall be 1/16 inch.

E. Wall Framing Requirements:

1. At bearing walls, coordinate wall stud locations to line up directly below floor framing.

2. Wall studs shall line up vertically between floors.

3. Wall panels shall be constructed to provide full bearing of panel bottom plate to supporting structure.

4. Construct wall panels to allow for field placement of top-most top plate to ensure overlapping of all joints

F. Sheathing Requirements:

1. All horizontal joints in plywood sheathing shall be blocked with full-depth blocking.

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2. Attach adjacent panels together by overlapping sheathing a minimum of 1 ½" and fastening with approved fasteners specified.

3.02 FRAMING

A. Set members level and plumb, in correct position.

B. Unless noted otherwise, wall top plates shall be doubled. Install top plates with overlapping corners and at intersections with adjoining partitions. End joints in double top plates shall be offset at least 48 inches.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Place horizontal members, crown side up.

E. Construct load bearing framing members full length without splices.

F. Double members at openings over 24 inches wide and as indicated. Space short studs over and under opening to stud spacing.

G. Double joists under partitions that run parallel to joist framing.

H. Posts and columns shall be blocked at floor and/or roof levels with framing matching or exceeding post dimensions down to supporting foundation.

I. Place sill gasket directly on cementitious foundation. Puncture gasket clean and fit tight to protruding foundation anchor bolts.

J. Coordinate installation of wood decking, joist members, rafter members and/or prefabricated wood trusses.

K. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

L. Coordinate curb installation with installation of decking and support of deck openings, and roofing vapor retardant.

M. Rough Carpentry Fastening Schedule: Unless otherwise indicated on the drawings, provide minimum nailing and fastening per IBC Table 2304.9.1.

3.03 SHEATHING

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A. Secure roof sheathing with longer edge perpendicular to framing members and with ends staggered and sheet ends over bearing provide gap between panels as recommended by manufacturer. Utilize H-clips at panel edges per manufacturer's recommendations or as indicated. Provide blocking where indicated on the Drawings.

B. Secure floor sheathing with longer edge perpendicular to framing members and with ends staggered and sheet ends over bearing. Secure tongue in groove per manufacturers instructions. Glue and nail/screw as indicated. Provide blocking where indicated on the Drawings. Floor sheathing shall be laid out in a manner to prevent squeaks.

C. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.

D. Install telephone and electrical panel backboards with plywood sheathing material where required. Size as indicated, 6 inch larger than panel space required or per local Code requirements.

3.04 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Fasteners Driving Tolerance: Unless noted otherwise, fastener heads shall be driven flush with attached framing member or sheathing. Maximum indentation tolerance from flush shall be 1/16 inch.

END OF SECTION

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SECTION 06 17 53

METAL PLATE CONNECTED PRE-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.

B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.

C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

A. Definition: Prefabricated wood trusses include planar structural units consisting of metal plate connected members which are fabricated from dimension lumber and which have been cut and assembled prior to delivery to the job site. Work to include anchorage, blocking, curbing, miscellaneous framing and bracing.

B. Types of fabricated wood trusses are indicated on the drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 06 10 00 - Rough Carpentry

1.04 QUALITY ASSURANCE:

A. TPI Standards: Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications, Latest Edition:

1. ANSI/TPI 1 “National Design Standard for Construction. Metal Plate Connected Wood Truss.”

2. ANSI/AF&PA (American Forest & Paper Association) – NDS National Design Specification for Wood Construction – Latest Edition

3. “Commentary and Appendices to ANSI/TPI 1 for Bracing Wood Trusses.”

4. “Building Component Safety Information, BCSI 1”

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5. DSB-89 “Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses.”

6. “Quality Assurance Procedures Manual for In-Plant Inspections, QAP-90.”

7. “Quality Control Manual.”

8. “Code of Federal Regulations, Part 1926” per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).

B. Wood Structural Design Standard: Comply with applicable requirements of "National Design Specification for Wood Construction", published by American Forest and Paper Association.

C. Lumber Standard: Comply with PS 20 and with applicable rules of the respective grading inspecting agencies for species and grade of lumber indicated.

D. Connector Plate Manufacturer's Qualifications: Provide truss connector plates manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "Quality Control Manual."

E. Fabricator's Qualifications:

1. Provide trusses by a firm which has a record of successfully fabricating trusses similar to type and length indicated.

2. TPI Inspection Program: Fabricator shall participate in the TPI Quality Assurance Inspection Program, and maintain a copy of the Quality Assurance Procedures Manual, QAP-90. All trusses fabricated for this project shall bear the TPI Registered Mark to indicate compliance with this program.

F. Uniformity of Manufacturer for Connector Plates: Provide metal connector plates form a single manufacturer.

1.05 SUBMITTALS:

A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with Division 1.

B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner’s Notice to Proceed.

C. All submittals shall be reviewed and returned to the Architect within 10 working days.

D. Incomplete submittals will not be reviewed.

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E. Submittals not review by the General Contractor prior to submission the Engineer will not be reviewed. Include on the submittal a statement or stamp of approval by the Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in sections Division 1 have been complied with.

F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.

G. **Truss design calculations without the appropriate signature and seal indicated below will be rejected and returned without review.**

H. Product Data: Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, treatment (if any), handling and erection.

1. Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.

2. Submit evidence of participation in the TPI Inspection program.

3. LEED Documentation: Refer to paragraph 1.07 of this section and Section 01 33 00.

I. Shop Drawings: Submit shop drawings, showing species, sizes and stress grade of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type size, material, finish, design value and location of metal connector plates; and bearing and anchorage details. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

1. Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.

2. **Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**

3. Truss Placement Plan: Provide drawings indicating truss layout.

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a. Include all trusses and components, including girder trusses, piggyback trusses, and hangers.

b. Provided dimensions for layout, including bearing locations & widths, and truss spacing

4. Design: Design shall be in accordance with the applicable provisions of the latest edition of the American Forest & Paper Association's (AF&PA's) National Design Specification for Wood Construction, ANSI/TPI 1, and all applicable legal requirements. Submit the following information in the calculation submittal for each truss or truss component. **Calculations are to be prepared under the direct supervision of a Professional Engineer Registered in the State of Maine. Calculations shall be signed and sealed by a Professional Engineer Registered in the State of Maine.** Truss designer is responsible for the design of the entire truss assembly, including permanent lateral bracing. Lateral loads shall be resolved into the building lateral load resisting system.

a. Loading: Include all loadings applied to the truss, including uniform, concentrated loads and locations. Include effects of mechanical equipment and drifted snow. Indicate distribution of loads to top and bottom chords. The calculations shall clearly show these loads and their application to the trusses.

b. Wind & Seismic Loading Criteria: Include all appropriate information wind & seismic loading criteria. Including design code, wind speed and exposure. Design code and wind speed shall be as indicated in the drawings.
   1. Provide uplift calculations and truss uplift reactions as appropriate.

c. Load Combinations: The calculations shall list all load combinations including all factors that apply.

d. Adjustments to lumber and metal connector plate design values for conditions of use. Adjustment of value for duration of load or conditions of use shall be in accordance with AF&PA's National Design Specification for Wood Construction.

e. Truss-to-Truss Connections: Provide hanger designs where applicable. Provide design of connectors in multi-ply trusses. Provide connection design for piggyback trusses.

f. Stress and Deflection calculations: Provide member stresses and joint displacement for each load and load combination, and displacement to span ratio. Indicate camber independently from displacement calculations. Provide bearing stresses at supports.

Deflection Limits: Design trusses to limit deflection under design live or snow loads to L/360 for roof trusses, L/480 for floor trusses.

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g. Reaction: Provide minimum and maximum reactions, including uplift as applicable. Indicate the load combination that produces these reactions.

h. Net Section at Hanger Connections: Design shall account for the net section loss to truss members from hung mechanical, electrical, plumbing and fire protection systems. General contractor shall coordinate hanger systems with the truss designer. Hanger systems are not designed by the Engineer of Record. See the "Execution" portion of this specification for additional requirements.

5. Field built trusses: To the greatest extent possible, trusses are to be prefabricated. Truss field fabrication is subject to the approval of the Structural Engineer. Additional design, quality assurance and quality control procedures may be necessary based on the requirements of the Structural Engineer.

6. Truss Assembly Drawings: Provide drawings depicting how each truss is to be constructed. Provide all geometry, including length, height, joint locations, slope, camber, overhangs, metal plate connectors, and lumber grades

7. Permanent Member Bracing: The truss manufacturer shall specify all permanent bracing required for lateral support of tension and compression members, both webs and chords. Permanent bracing loads shall be resolved to the building lateral load resisting system. Provide strong back locations for parallel chord floor trusses.

8. With all copies of drawing submittal provide "BCSI 1 (latest edition) Guide to Good practice for Handling, Installing & Bracing of Metal Plate Wood Trusses", Jointly produced by the Wood Truss Council of America and the Truss Plate Institute.

1.06 DELIVERY, STORAGE, HANDLING:

A. Handle and store trusses with care, and in accordance with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.

B. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

C. A copy of the BCSI (latest edition) Summary Sheet, "Guide for Handling, Installing and Bracing of Metal Plate Connected Wood Trusses" shall be provided to the installer at delivery.

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1.07 LEED Requirements:

A. Regional materials, regional manufacturer: Use dimensioned lumber manufactured within 500 mile radius of project.

B. Regional materials, regional extraction: Use dimensioned lumber extracted, harvested or recovered within 500 mile radius of project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal connector plates which may be incorporated in the work include, but are not limited to, the following:

Gang Nail Systems, Inc.
Hydro-Air Engineering, Inc.
Inter-Lock Steel Co., Inc.
Link-Wood Construction Systems
Robbins Manufacturing Co.
Tee-Lok Corp.
Truss Connectors of America
Truswall Systems Corp.

2.02 MATERIALS:

A. Lumber:

1. Factory mark each plate of lumber with type, grade, mill and grading agency.

2. Provide actual sizes as required by PS 20 for dressed limber, S4S, unless otherwise indicated. Minimum member sizes (nominal) are as follows:

a. Chord members, parallel chord trusses: 4x2 (“flat” orientation)

b. Web members: 2x4

3. Provide seasoned lumber with a maximum moisture content of 19% at time of dressing, and the moisture content of lumber shall be no less than 7% at time of manufacturing.

4. Lumber Species: Eastern Woods (Spruce) graded by NLGA, NELMA or NHPMA. Southern Pine graded by SPIB. Douglass Fir Larch graded by NLGA.

5. Lumber Grade:

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a. Chord Members: MSR 1650f-1.5E lumber for all chords.

b. Web Members: No. 2 or better visually graded lumber for all webs. MSR lumber is acceptable in lieu of visually graded lumber for web members.

6. Stress Rating: Provide lumber which has been either graded or tested and certified, at indicated moisture content, to have the following minimum values:

a. MSR: Fb = 1650 psi, Ft = 1020 psi, Fc = 1700 psi, E = 1,500,000 psi

b. No.2: Fb = 875 psi, Ft = 450 psi, Fc = 1150 psi, E = 1,400,000 psi

7. Pressure treated lumber shall not be used.

B. Metal Connector Plates, Fasteners and Anchorages:

1. Connector Plate Material: Metal complying with following requirements, unless otherwise indicated: Not less that 0.036" thick, coated thickness, and shall meet or exceed ASTM A653/ASTMA653M grade 33. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with ANSI/TPI

a. Galvanized Sheet Steel: ASTM A924/924M, Coating G60.

b. Electrolytic Zinc Coated Steel Sheet: ASTM A 591, Coating Class C, with minimum structural quality equivalent to ASTM A 446, Grade A.

C. Hangers and Uplift Anchors: Hangers are to be designed and supplied as part of the truss package, and shall be manufactured by Simpson StrongTie. Preliminary uplift anchors are indicated on the Contract Documents. Final uplift connector type and/or quantity will be selected based on truss reactions. G.C. coordinate with engineer's marks on approved truss shop drawings.

2.03 FABRICATION:

A. Trusses shall be fabricated to meet the quality requirements of ANSI/TPI 1.

B. Cut truss members to accurate lengths, angles and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.

C. Fabricate metal connector plates to size, configuration, thickness and anchorage details required for types of joint designs indicated.

D. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.

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E. Connect truss members by means of metal connector plates accurately located and securely fastened to wood members by means indicated or approved.

F. Permanent web member bracing locations shall be marked on the truss members by means of a paint mark or tag of contrasting color. Tags shall not be removed without the permission of the Architect.

G. All trusses shall bear the TPI Registered Mark, The TPI Quality Stamp, indicating current participation with the in-plant inspection program per the standards established in QAP-90.

PART 3 - EXECUTION

3.01 GENERAL:

Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute. Erection shall comply with current Occupational Safety & Health Administration (OSHA) requirements.

A. Inspect trusses for damage prior to erection. Apparent damage to trusses, if any, shall be reported to Truss Manufacturer prior to erection.

B. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the Contractor to the individual or organization responsible for the installation of the Trusses.

C. Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacing indicated. Where applicable, insure bearing wall studs and trusses are aligned. The maximum out-of-true plumb tolerance shall be the depth of the truss in inches divided by 100. The maximum bow tolerance from true straight shall be the length of the truss in inches divided by 400, at any point considering multiple curvature when applicable.

D. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

E. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated. Temporary bracing during construction is the responsibility of the contractor and the installer, as part of the contractor's "Means and Methods". TEMPORARY BRACING MUST BE PROVIDED IN THREE DIFFERENT PLANES OF THE TRUSS. BRACING SHALL BE INSTALLED ALONG THE BOTTOM CHORD, ALONG THE TOP CHORD AND WITHIN THE WEB MEMBERS. CONTRACTOR SHALL FOLLOW THE RECOMMENDATIONS OF SUMMARY SHEETS BCSI-B1/B2 FOR HANDLING, INSTALLING AND BRACING METAL CONNECTED WOOD TRUSSES. TEMPORARY BRACING SHALL BE LEFT IN PLACE AND BECOME PART OF THE PERMANENT BRACING FOR THE BUILDING. MAXIMUM BRACE SPACINGS INDICATED IN THIS DOCUMENT SHALL NOT BE EXCEEDED.

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F. Modifications required to the temporary bracing to comply with permanent bracing requirements, if any, shall be noted on the Structural Contract Documents. Install necessary supplemental permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.

G. Anchor trusses securely at all bearing points to comply with methods and details indicated.

H. Do not cut, notch, bore, drill or remove truss members.

I. Hanging Loads: Hangers for mechanical, electrical, plumbing and fire protection systems, including but not by limitation, piping, conduit, ducting and mechanical equipment, shall be made to top of the bottom chord of the truss. Connections that require fasteners to penetrate the chord longitudinally shall not be utilized. Hanger loads shall be placed at truss panel points where required by the truss design.

J. Metal plates shall not be removed and/or be replaced. Plates that are not fully pressed into the wood shall not be repaired without the direction of the Truss Manufacturer. The Architect and Truss Manufacturer shall be notified of deficient metal plate installation. Repairs shall be submitted to the Architect for review prior to implementation.

END OF SECTION

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SECTION 062013

EXTERIOR FINISH 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. This Section includes the following:

1. Exterior decking.
2. Cellular PVC trim
3. Building wrap.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 07 Section "Siding" for fiber-cement siding and trim.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. Samples for Verification: For each product.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.

2. Product Data for Credit 2.1: FSC certified Tropical Wood.

a. If the products are FSC certified, provide FSC chain of custody (COC) certification

D. Warranties: Special warranties specified in this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack materials as recommended by the manufacturer. Provide for air circulation within and around stacks and under temporary coverings.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 DECKING

A. Exterior Decking: Composite material consisting of recycled plastic and wood, formed to 5/4 inch by 6 inch decking. Provide one of the following manufacturers or approved substitute:

1. Trex Company, LLC, Trex Decking.
2. LP Building Products, WeatherBest Decking.
3. CorrectDeck, Classic Composite Decking.

2.2 WEATHER-RESISTANT BUILDING WRAP

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. DuPont (E. I. du Pont de Nemours and Company); Tyvek [**CommercialWrap**] [**StuccoWrap**] [**HomeWrap**] [**HomeWrap and HeaderWrap**].
b. Ludlow Coated Products; [**Air Stop Housewrap**] [**Barricade Building Wrap**] [**EnergyWrap Housewrap**] [**R-Wrap Protective House Wrap**].
c. Pactiv, Inc.; GreenGuard [**Classic Wrap**] [**RainDrop**] [**Ultra Wrap**] [**Value Wrap**].
d. Raven Industries Inc.; Rufco-Wrap.
e. Reemay, Inc.; Typar HouseWrap.

2. Water-Vapor Permeance: Not less than [**535**] [**152**] [**125**] [**63**] <**Insert number**> g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
3. Allowable UV Exposure Time: Not less than three months.

B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Decking: Provide fasteners as recommended by the decking manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, 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.

3.2 DECKING INSTALLATION

A. Install decking in accordance with manufacturer’s recommendations.

B. Decking to span a minimum of three framing members.

C. Gapping: Provide the following gaps at sides and ends of decking:

1. Sides: 1/4 inch gap for installation temperature above 40 deg F; 3/8 inch gap for installation temperature below 40 deg F.
2. End-to-End: 1/8 inch gap for installation temperature above 60 deg F; 3/16 inch gap for installation temperature below 60 deg F.
3. Abutting Solid Objects: 1/4 inch gap for installation temperature above 60 deg F; 1/2 inch gap for installation temperature below 60 deg F.

3.3 WEATHER-RESISTANT BUILDING WRAP INSTALLATION

A. General: Cover sheathing with weather-resistant building wrap as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.4 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.5 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 062023

INTERIOR FINISH 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. This Section includes the following:

1. Interior standing and running trim.
2. Wire shelving systems.
3. Wood door frames.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Division 09 Section "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 DEFINITIONS

A. 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 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Samples for Verification:

1. For each species and cut of lumber products with non-factory-applied finish, with 1/2 of exposed surface finished, 50 sq. in. for lumber.

C. LEED Submittal:

1. Product Data for Credit MR 2.1: Provide certifications for FSC Certified Tropical Wood.
2. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. FSC-certified wood products: If tropical wood is provided, provide wood products that come from suppliers that have been granted chain-of-custody by Forest Stewardship Council.
d. Low or No emissions of VOC: Provide glues and adhesive materials that comply with VOC limits in reference tables.
e. Provide required documentation for all the above requirements with submittals to verify the compliance.

D. Warranty: Special warranty specified in this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. General: Provide FSC Certified lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.

1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
2. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.2 STANDING AND RUNNING TRIM

A. Lumber Trim for Opaque Finish (Painted):

1. Species and Grade: Eastern white pine, No. 2; NeLMA or NLGA.
2. Maximum Moisture Content: 10 percent.
3. Finger Jointing: Allowed.
4. Face Surface: Surfaced (smooth).

2.3 WIRE SHELVING SYSTEM

A. Wire shelving system by ClosetMaid: Provide the following components or approved substitute:

B. Provide the following at each room closet:

1. Hang Track: Provide hang track, full width of closet.
2. Standards: Provide 12 inch standards, one for each 16 inches of closet width plus one.
3. Brackets: Provide shelf bracket, Item no. 32853. Provide one for each standard.
4. Shelf: Close Mesh Shelf, 16 inches wide, one shelf full width of closet.
5. Closet Rod: Hang Rod, full width of closet and shelf.
6. Closet Rod Support: Provide closet rod support, Item no. 5629. Provide one for each 2 standards.

C. Provide the following at each linen closet:

1. Hang Track: Provide hang track, full width of closet.
2. Standards: Provide 48 inch standards, one for each 16 inches of closet width plus one.
3. Brackets: Provide shelf bracket, Item no. 32853. Provide one for each standard and shelf.
4. Shelf: Close Mesh Shelf, 20 inches wide, five shelves full width of closet.

2.4 WOOD DOOR FRAMES

A. Frames fabricated from pine frame, machined for 1-3/8 and 1-3/4 inch thick door, clear material, to accommodate wall thickness indicated.

1. Rabbeted Jamb: Provide 1-1/4 inch thick, pine

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

1. Use adhesive that has a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FABRICATION

A. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
2. Install trim after gypsum board joint finishing operations are completed.
3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 WIRE SHELVING SYSTEM INSTALLATION

A. Install according to manufacturer's written instructions.

B. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

3.6 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during remainder of the construction period.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 071113

BITUMINOUS DAMPPROOFING

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. Cold-applied, emulsified-asphalt dampproofing.

B. Related Sections include the following:

1. Division 07 Section "Sheet Waterproofing" for waterproofing.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

B. Material Certificates: For each product, signed by manufacturers.

C. LEED Submittals: Not required.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

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. Degussa Building Systems; Sonneborn Brand Products.
2. Karnak Corporation.
3. Meadows, W. R., Inc.

B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1 or Type IV.

1. Available Products:

a. Sealmastic, Type 2; W. R. Meadows
b. Hydrocide 700B; Sonneborn Building Products.
c. Karnak 220 AF; Karnac Chemical Corp.

C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

1. Available Products:

a. Sealmastic, Type 1; W. R. Meadows
b. Hydrocide 600; Sonneborn Building Products.
c. Karnak 100 AF; Karnac Chemical Corp.

D. VOC Content: 0.25 lb/gal. or less.

2.2 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

C. Patching Compound: Epoxy or latex-modified repair mortar or manufacturer's fibered mastic of type recommended by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

2. Test for surface moisture according to ASTM D 4263.

3.2 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
3. Allow 24 hours drying time prior to backfilling.

B. Apply dampproofing to provide continuous plane of protection on exterior face of inner wythe of exterior masonry cavity walls.

1. Lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
2. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe, and lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. On Exterior Face of Inner Wythe of Cavity Walls: Apply primer and 1 brush or spray coat at not less than 1 gal./100 sq. ft..

3.5 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 071300

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. This Section includes the following:

1. Rubberized-asphalt sheet waterproofing.
2. Fluid -applied waterproofing.
3. Drainage panels.

1.3 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

C. Samples: For the following products:

1. 12-by-12-inch (300-by-300-mm) square of waterproofing and flashing sheet.
2. 12-by-12-inch (300-by-300-mm) square of insulation.
3. 4-by-4-inch (100-by-100-mm) square of drainage panel.

D. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

E. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.

F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

G. LEED submittals: none required.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who is authorized, approved, or licensed by waterproofing manufacturer to install manufacturer's products.

B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review requirements for waterproofing, including surface preparation specified under other Sections, 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

D. Store rolls according to manufacturer's written instructions.

E. Protect stored materials from direct sunlight.

1.7 PROJECT 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. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.

1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.
2. Warranty Period: Two years after date of Substantial Completion.

B. Special Installer's Warranty: Written waterproofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, for warranty period of two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contractor may provide either sheet or fluid-applied waterproofing system for walls. Provide only sheet membrane system for horizontal deck application.

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. Rubberized-Asphalt Sheet Waterproofing:

a. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; CCW 701.
b. W. R. Grace & Co.; Bituthene.
c. W. R. Meadows, Inc.; Mel-Rol.
d. T. C. Miradri; Miradri.
e. Pecora Corporation; Duramem 700-SM.
f. Tamko Roofing Products, Inc.; TW-60.

2. Fluid-applied Waterproofing:

a. W. R. Grace & Co.; Procor 75.
b. W. R. Meadows, Inc.; Sealtight® Meadow-Pruf™ Seamless.
c. Kosh Waterproofing Solutions, Inc.: Exotite Waterproofing.
d. OZKO, Inc.; Rub-R-Wall

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

A. Rubberized-Asphalt Sheet: 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side.

1. Physical Properties: As follows, measured per standard test methods referenced:

a. Tensile Strength: 250 psi (1.7 MPa) 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 (minus 29 deg C); ASTM D 1970.
d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
f. Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.
g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
h. Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

2.3 FLUID-APPLIED WATERPROOFING

A. Fluid Applied Waterproofing Membranes: Two part, self-curing, synthetic rubber based material. Fluid applied membranes shall meet or exceed the performance requirements of ASTM C 836.

B. Physical Properties: As follows, measured per standard test methods referenced:

1. Cured Film Thickness: 0.060 inch (1.5 mm) nominal; ASTM D 3767 Method A.
2. Flexibility: Pass at minus 180° bend over 25 mm (1 in.) mandrel at 32°C (-25°F); ASTM D 1970.
3. Peel Adhesion to Concrete: 5 lbf/in. (880 N/m); ASTM D 903, modified.
4. Solids Content: 100 percent; ASTM D 1970.
5. Elongation: 500 percent minimum; ASTM D 412.
6. Hydrostatic-Head Resistance: 75 feet (23 m) minimum.

2.4 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.

E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches (114 mm) wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
2. Detail Strips: 62.5-mil- (1.58-mm-) thick, felt-reinforced self-adhesive strip, 9 inches (230 mm) wide, with release film on adhesive side.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, and sound; ready to receive HDPE sheet.
4. 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 and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch (1.6 mm).

F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.

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 (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:

    a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.

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 RUBBERIZED-ASPHALT SHEET APPLICATION

A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow 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- (64-mm-) 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 (minus 4 and plus 5 deg C), install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.

E. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.

F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches (150 mm) beyond repaired areas in all directions.

G. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 FLUID-APPLIED WATERPROOFING APPLICATION

A. Install fluid-applied waterproofing according to waterproofing manufacturer's written instructions.

B. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid applied waterproofing.

C. Fill form tie rod holes with concrete and finish flush with surrounding surface.

D. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.

E. Grind irregular construction joints to suitable flush surface.

F. Apply minimum 1.5 mm (0.060 in.) in all areas to be waterproofed. Apply minimum 3 mm (0.120 in.) in all detail areas.

3.5 PROTECTION AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

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. This Section includes the following:

1. Perimeter insulation under slabs-on-grade.
2. Perimeter wall insulation (supporting backfill).
3. Concealed building insulation.
4. Self-supported, spray-applied cellulosic insulation.
5. Vapor retarders.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for insulation installed in cavity walls and masonry cells.
2. Division 07 Section "Polymer-Based Exterior Insulation and Finish System (EIFS)" for insulation specified as part of these systems.
3. Division 07 Section "Built-up Asphalt Roofing Built-up Coal Tar Roofing Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
4. Division 09 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.
5. Division 21 Section "Fire-Suppression Systems Insulation."
6. Division 22 Section "Plumbing Insulation."
7. Division 23 Section "HVAC Insulation."

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

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

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables.
d. Provide required documentation for all the above requirements to verify compliance.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

E. Research/Evaluation Reports: For foam-plastic insulation.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation 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.

B. Protect 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 plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. 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 FOAM-PLASTIC BOARD INSULATION

A. Recycled Content: Provide extruded polystyrene insulation with recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 30 percent.

B. Rigid Insulation: Extruded-Polystyrene Board Insulation; ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

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. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.
3. Application: Foundation insulation. Rigid insulation below concrete slab-on-grade.

2.3 GLASS-FIBER BLANKET INSULATION

A. Recycled Content: Provide glass-fiber insulation with recycled content so postconsumer recycled content is not less than 25 percent.

B. Available Manufacturers:

1. Guardian Fiberglass, Inc. (30% post consumer, 5% post industrial)
2. Owens Corning. (40% recycled content)

C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches thick with a thermal resistance of R-13.
2. 5-1/2 inches thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F.

2.4 LOOSE-FILL INSULATION

A. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.

1. Available Products:

a. Nu-Wool Attic Insulation.
b. Cocoon2 Stabilized Attic Insulation, product no. INS500 for spray, no. INS510LD for poured.

B. Glass-Fiber Loose-Fill Insulation: ASTM C 764 for type (method of application) indicated below; maximum flame-spread and smoke-developed indices of 5, and as follows:

1. Type 1 for pneumatic application.
2. Type 2 for poured application.

2.5 SPRAY-APPLIED CELLULOSIC INSULATION

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics, sprayed-in-place to a density of 3.0 to 3.5 lbs per cubic foot.

1. Available Products:

a. Nu-Wool WallSeal Cellulose Insulation.
b. Cocoon2 Stabilized Borate Formula Insulation, product no. INS735.

2. Application: Exterior thermal insulation.

2.6 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.

2.7 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

1. Available Products: 3M Builder's Sealing Tape No. 8086.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated 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. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, 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.

3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.

D. Place loose-fill insulation into spaces indicated, by machine blowing, to comply with ASTM C 1015. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic-fiber loose-fill insulation, comply with the Cellulose Insulation Manufacturers Association's Special Report #3, "Standard Practice for Installing Cellulose Insulation."

E. Apply self-supported, spray-applied cellulosic insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it flush with face

of studs by using method recommended by insulation manufacturer. Allow insulation to dry for 24 hours before enclosing insulation with wall covering.

F. 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.

3.6 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.7 PROTECTION

A. Protect installed insulation and vapor retarders 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

SECTION 072413

POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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 insulation and finish system (EIFS) applied over plywood sheathing.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for sheathing.
2. Division 07 Section "Joint Sealants" for sealing joints in EIFS with elastomeric joint sealants.

1.3 SYSTEM DESCRIPTION

A. Class PB EIFS: A non-load-bearing, exterior wall cladding system that consists of an insulation board attached adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

1.4 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with the following:

1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
2. Weathertightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.

B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following:

1. Abrasion Resistance: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days; and showing no cracking,

checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.

2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
3. Accelerated Weathering: Five samples per ICC-ES AC219 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154.
4. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01.
5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
6. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC219.
7. Tensile Adhesion: No failure in the EIFS, adhesive, base coat, or finish coat when tested per EIMA 101.03.
8. Water Penetration: Sample consisting of 1-inch- thick EIFS mounted on 1/2-inch-thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
9. Water Resistance: Three samples, each consisting of 1-inch- thick EIFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
10. Wind-Driven-Rain Resistance: Resist wind-driven rain according to ICC-ES AC219.
11. Impact Resistance: Sample consisting of 1-inch- thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:

    a. Standard Impact Resistance: 25 to 49 inch-lb.
    b. Medium Impact Resistance: 50 to 89 inch-lb.
    c. High Impact Resistance: 90 to 150 inch-lb.
    d. Ultra-High Impact Resistance: More than 150 inch-lb.

12. Structural Performance Testing: EIFS assembly and components shall comply with ICC-ES AC219 when tested per ASTM E 330.

1.5 SUBMITTALS

A. Product Data: For each type and component of EIFS indicated.

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

    a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.

b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Provide required documentation for all the above to verify compliance.

C. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.

D. Samples for Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of joint sealants and exposed accessories involving color selection.

E. Manufacturer Certificates: Signed by manufacturers certifying that EIFS comply with requirements.

F. Material or Product Certificates: For cementitious materials and aggregates and for each insulation and joint sealant, from manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for eachinsulation, reinforcing mesh, joint sealant, and coating.

H. Compatibility and Adhesion Test Reports: For joint sealants from sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

I. Maintenance Data: For EIFS to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

C. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.

2. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per ASTM E 84.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution and set quality standards for fabrication and installation.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions required for prefabricated panels by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, weather-resistant sheathing paper, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and barrier coating of EIFS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dryvit Systems, Inc.
2. Parex, Inc.; a brand of ParexLahabra, Inc.
3. Senergy; Degussa Wall Systems, Inc.
4. Sto Corp.
5. Total Wall Inc.

2.2 MATERIALS

A. Compatibility: Provide adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by EIFS manufacturer for Project.

B. Primer/Sealer: EIFS manufacturer's standard substrate conditioner[**with VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24),**] designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.

C. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

D. Extruded-Polystyrene Board Insulation; ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

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. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.
3. Dimensions: Provide insulation boards not more than 24 by 48 inches and in thickness indicated, but not more than 4 inches thick or less than thickness allowed by ASTM C 1397.

E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:

1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd..
2. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd..

F. Base-Coat Materials: EIFS manufacturer's standard mixture complying with the following:

1. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

G. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.

H. Finish-Coat Materials: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance complying with the following:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
2. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
3. Colors: As selected by Architect from manufacturer's full range.

I. Water: Potable.

J. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; selected for properties of pullout, tensile, and shear strength required to resist design loads of application indicated; capable of pulling fastener head below surface of insulation board; and of the following description:

1. For attachment to steel studs from 0.033 to 0.112 inch in thickness, provide steel drill screws complying with ASTM C 954.
2. For attachment to light-gage steel framing members not less than 0.0179 inch in thickness, provide steel drill screws complying with ASTM C 1002.
3. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C 1002, Type W.
4. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
5. For attachment, provide manufacturer's standard fasteners suitable for substrate.

K. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard Cell Class for use intended, and ASTM C 1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.

2.3 ELASTOMERIC SEALANTS

A. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and

other related materials, and complies with requirements for products and testing indicated in ASTM C 1481 and with requirements in Division 07 Section "Joint Sealants" for products corresponding to description indicated below:

1. Single-component, nonsag, neutral-curing silicone sealant.

B. Sealant Color: As selected by Architect from manufacturer's full range.

2.4 MIXING

A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

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 EIFS.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Begin coating application only after surfaces are dry.
2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

3.3 EIFS INSTALLATION, GENERAL

A. Comply with ASTM C 1397 and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 TRIM INSTALLATION

A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated, according to EIFS manufacturer's written instructions. Coordinate with installation of insulation.

1. Expansion Joint: Use where indicated on Drawings.
2. Casing Bead: Use at other locations.

3.5 INSULATION INSTALLATION

A. Board Insulation: Mechanically attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written instructions, and the following:

1. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written instructions. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

    a. Wood Framing: 1 inch.

2. Begin first course of insulation from a straight base line and work across ceiling.
3. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.

    a. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

4. Interlock ends at internal and external corners.
5. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
6. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
7. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch.
8. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
9. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
10. After installing insulation and before applying reinforcing mesh, fully wrap board edges with strip reinforcing mesh. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
11. Treat exposed edges of insulation as follows:

    a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.

b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

12. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective-coating lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where EIFS manufacturer requires joints in long continuous elevations.

3.6 BASE-COAT INSTALLATION

A. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch dry-coat thickness.

B. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.

1. Standard-impact reinforcing mesh unless otherwise indicated.

C. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches wide.
2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.7 FINISH-COAT INSTALLATION

A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Texture: As selected by Architect from manufacturer's full range.

2. Embed aggregate in finish coat according to EIFS manufacturer's written instructions to produce a uniform applied-aggregate finish of color and texture matching approved sample.

C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.8 INSTALLATION OF JOINT SEALANTS

A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 07 Section "Joint Sealants" and in ASTM C 1481.

1. Apply joint sealants after base coat has cured but before applying finish coat.
2. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
3. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
4. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
5. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
6. Recess sealant sufficiently from surface of EIFS so an additional sealant application, including cylindrical sealant backing, can be installed without protruding beyond EIFS surface.

3.9 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION

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 (300 mm) square units for each type of vapor retarder, vapor barrier, or air barrier indicated.

C. LEED submittals: none required

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.

1.6 PROJECT CONDITIONS

A. Separate and recycle waste materials.

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 for VCT and other moisture vapor sensitive flooring applications having the following qualities:

1.	Minimum Permeance:	ASTM E-96, not greater than 0.04 perms.
2.	Tensile Strength:	ASTM E154 or D638, Class B – over 30 lbs/in.
3.	Puncture Resistance:	ASTM E-154, Class C – over 475 grams.
4.	Water Vapor Barrier:	ASTM E-1745, meets or exceeds Class C.
5.	Thickness of Barrier (Plastic)	ACI 302.1R-96, not less than 10 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, 10 mil thick vapor retarder by Stego Industries LLC, (877) 464-7834.
2. Griffolyn Type-65 by Reef Industries.
3. Vapor Block 10 by Raven Industries.
4. MoistStop Ultra A by Fortifiber.
5. Sealtight Perminator 10 mil Underslab Vapor-Mat by W.R. Meadows, Inc.
6. Viper VaporCheck 10 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.

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 Iso-Strip isolation 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

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.

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: 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. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

a. Uniform pressure of 30 lbf/sq. ft., acting inward or outward.

2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/240 of the span.

F. 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 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. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material. Provide documentation from manufacturer to verify compliance.

C. 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.

D. Samples for Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

E. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panels and attachments.
2. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
3. Penetrations of wall by pipes and utilities.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

G. Maintenance Data: For metal wall panels to include in maintenance manuals.

H. Warranties: Sample of special warranties.

1.6 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. 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.

1.7 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.

1.8 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.

1.9 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 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. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
3. Surface: Smooth, flat finish.
4. Exposed Coil-Coated Finish:

a. 2-Coat Fluoropolymer: AAMA 621. 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.

5. 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. Refer to Division 07 Section "Thermal Insulation."

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Zee Clips: 0.079-inch nominal thickness.

C. 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: 0.025 inch.

D. 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 and other suitable fasteners designed to withstand design loads.

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 in side laps. Include accessories required for weathertight installation.

B. Standing-Seam-Profile, Concealed-Fastener Metal Wall Panels: Formed with raised, curved-top, standing-seam-shaped major rib at panel edge and flat pan between major rib and panel edge.

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. ARS Architectural Roofing & Siding: Snap Rib (16”).
b. Berridge: Cee-Lock (16”).
c. BHP Steel Building Products USA, Inc.: Design Span (17”).

d. Centria: SDP (16").
e. Fabral Metal Roofing and Siding: Slim Seam (16").
f. McElroy Metal, Inc.: Medallian-Lok (16").
g. Morin Corporation: SSL 15-1/2.

2. Material: Zinc-coated (galvanized) steel sheet, 24 gage nominal thickness.

a. Exterior Finish: 2-coat fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

2.6 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. 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 24 gage minimum thickness, zinc-coated (galvanized) steel sheet 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.

2.7 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 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 Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams.
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.

2.8 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 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation in thickness indicated to cover entire wall. Comply with installation requirements in Division 07 Section "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.
2. Retain insulation in place by metal clips and straps or integral pockets within panels, spaced at intervals according to insulation manufacturer's instructions. Maintain cavity width between insulation and metal liner panel of dimension indicated.

3.3 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. 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. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use 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 Division 07 Section "Joint Sealants."

E. Standing-Seam Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

3.4 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).

3.5 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

SECTION 074600

SIDING

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. Fiber-cement siding and trim.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood furring, grounds, nailers, and blocking.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Provide required documentation for all the above requirements to verify compliance.

C. Samples for Selection: For siding and trim including related accessories.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

E. Maintenance Data: For each type of siding and trim and related accessories to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.

B. Source Limitations: Obtain siding and trim, including related accessories, from single source from single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in a dry, well-ventilated, weathertight place.

1.6 COORDINATION

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING AND TRIM

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

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. Cemplank.
b. CertainTeed Corp.
c. GAF Materials Corporation.
d. James Hardie.

2. Horizontal Siding Pattern: Boards 7-1/4 inches wide in plain style.

a. Texture: Smooth.

3. Panel Texture: 48-inch- wide sheets with smooth texture.
4. Trim: Provide sizes as indicated on the drawings.
5. Factory Finishing: Manufacturer's standard acrylic finish.

2.2 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.

B. Aluminum Accessories: Where aluminum accessories are indicated, provide accessories complying with AAMA 1402.

1. Texture: Smooth.
2. Nominal Thickness: 0.019 inch.
3. Finish: Manufacturer's standard three-coat PVDF.

C. Flashing: Provide aluminum Z- flashing at window and door heads and where indicated.

1. Nominal Thickness: 0.019 inch.
2. Finish: Manufacturer's standard three-coat PVDF.

D. Fasteners:

1. For fastening fiber cement, use stainless-steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding and trim and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with siding and trim manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Do not install damaged components.
2. Center nails in elongated nailing slots without binding siding to allow for thermal movement.

B. Install fiber-cement siding and trim and related accessories.

1. Install fasteners no more than 24 inches o.c.

C. Install joint sealants as specified in Division 07 Section "Joint Sealants" and to produce a weathertight installation.

D. Where aluminum flashing will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION

SECTION 075323

ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) 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. Adhered EPDM membrane roofing system.
2. Roof insulation.
3. Walkway pads.
4. Roof drains.
5. Expansion joints.

B. Related Sections:

1. Division 01 Section “Alternates” for alternates related to this section.
2. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
4. Division 07 Section "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane 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. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane 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. Energy Performance (for alternate roofing): Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1.5 SUBMITTALS

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

B. LEED Submittals:

1. Product Test Reports for Credit SS 3.2 if applicable: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirement. To comply material shall have SRI equal to or greater than: Low slope roof (≤ 2:12) SRI 78; Steep slope roof (≥2:12) SRI 29 for 75% of roof area.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products, in manufacturer's standard sizes:

1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Six insulation fasteners of each type, length, and finish.
4. Six roof cover fasteners of each type, length, and finish.

E. Qualification Data: For qualified Installer and manufacturer.

F. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of complying with performance requirements.

G. Manufacturer’s installation rating of the roofing contractor.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

I. Maintenance Data: For membrane roofing system to include in maintenance manuals.

J. Warranties: Sample of special warranties.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Approvals approved for membrane roofing system identical to that used for this Project.

B. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product. Contractor shall have installed a minimum of 500,000 square feet and have a manufacturer's installation rating of 9.0 or better.

1. Installer for GAF products shall be a Master Select or Master Certified Contractor.
2. Work associated with single-ply membrane roofing, including (but not limited to) insulation, flashing, and membrane sheet joint sealers, shall be performed by Installer of this Work.

C. Source Limitations: Obtain components including roof insulation and fasteners Insert products for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies 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.

F. Preliminary Roofing Conference: Before starting roofing installation, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, 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. Review requirements for deck substrate conditions and finishes, 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 will affect 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.

G. Upon completion of the installation, an inspection shall be made by the system manufacturer to ascertain that the roofing system has been installed according to the applicable manufacturer's specifications and details. No "early bird" warranty will be accepted. The results of the warranty inspection shall be submitted in writing to Owner for their review and records.

1.7 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.

1.8 PROJECT 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.

1.9 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. A manufacturer’s sole source 15-year written Roofing System Warranty shall be provided with a peak gust wind speed limitation of 100 mph (measured 30 feet above the ground). Warranty shall cover both labor and materials with no dollar limitation and shall state that the Total roofing System will remain in a watertight condition. The contractor shall provide as part of the shop drawing submittal process, certification indicating that the manufacturer has reviewed and has agreed to such wind coverage indicated.

1. Roofing System is defined as the following materials and provided by the roof system manufacturer: membrane, flashings, counterflashings, adhesives, sealants, insulation, overlayment, fasteners, fastener plates, fastener strips, hard rubber, metal edging. Metal

termination anchor bars, roof drain flashing and sealants, and any other product utilized in this system installation.

2. The warranty shall be for fifteen (15) years starting after final acceptance of the total roofing system by the roof system manufacturer. Defective materials or installation shall be removed, properly disposed of, and replaced at the manufacturer's expense.
3. The warranty shall provide that if within the warranty period the roofing system becomes non-watertight or if the elastomeric sheet splits, tears, or separates at the seams because of defective materials and/or materials and cost thereof shall be the responsibility of the manufacturer. Should the manufacturer or his approve applicator fail to perform repairs within 72 hours of notification, the warranty will not be voided because of work being performed by others to repair the roofing regardless of the manufacturer's warranty to the contrary.
4. The Roofing System shall be applied by a roofing Contractor approved by the system manufacturer. After inspection and acceptance of the installed roof system, the warranty will be issued.
5. Submit an Extended Wind Speed Request Form for acceptance of 85 mph wind warranty prior to start of work. Notify Architect if request form is rejected from the manufacturer.

PART 2 - PRODUCTS

2.1 EPDM MEMBRANE ROOFING

A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle SynTec Incorporated.
    b. Firestone Building Products.
    c. GAF Materials Corporation.
    d. Versico Incorporated.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Black.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane 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 when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

    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. Contact Adhesive: 80 g/L.
f. Single-Ply Roof Membrane Sealants: 450 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: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Protection Sheet: Epichlorohydrin or neoprene non-reinforced flexible sheet, 55- to 60-mil-thick, recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.

D. Bonding Adhesive: Manufacturer's standard.

E. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 6-inch- wide minimum, butyl splice tape with release film.

F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.

J. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.

1. Products: Subject to compliance with requirements, provide the following:

a. Georgia-Pacific Corporation; Dens Deck.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

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 layers of 3 inch thick insulation, providing a total in place thickness of 6 inches, unless indicated otherwise.

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.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[**and cover boards**] to substrate, and acceptable to roofing system manufacturer.

C. Cover Board: DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

2.7 ROOF DRAINS

A. All roof drains shall be furnished with 15 inch diameter cast iron body, integral flashing flange and clamp device, cast iron dome strainer, top-set deck clamp. Equal to Zurn ZC-100-DP. See plumbing riser piping for sizes.

B. Roofing contractor to supply and install pressure-treated wood blocking as required for roof drains.

2.8 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 the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that 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.

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. 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.

3.3 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck according to manufacturer’s recommendations.
2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane 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.

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.

1. Fasten cover boards according to requirements of manufacturer’s warranty.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adheremembrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

D. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.

E. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

F. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping membrane roofing according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of membrane roofing terminations.

G. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant or mastic bed over deck drain flange at roof drains and securely seal membrane 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 membrane 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 splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 ROOF DRAIN INSTALLATION

A. Install roof drain and accessories in strict accordance with manufacturer’s written instructions, providing a permanent weather tight installation.

1. Inspect and determine substrate to be in satisfactory condition, with deck fully anchored and aligned at proper location and elevation. All surfaces shall be smooth, dry, clean, free of sharp edges, and other irregularities.
2. Attach deck flange securely to substrate.
3. Assemble and flash gravel stop flange into roof system per roof system and roof drain manufacturer requirements.
4. Securely attach strainer basket.

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 membrane roofing system where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will 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 membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane 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

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 Products:

a. Formed low-slope roof sheet metal fabrications.
b. Flashing associated with exterior siding and trim including but not limited to:
1) Window head metal zee trim flashing.
2) Metal zee flashing for all horizontal fiber cement trim.

2. Fabricated Products:

a. Grade level stainless steel through wall masonry flashing.

b. Aluminum gutter and downspouts at canopies provided by Alternate #2.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Metal Wall Panels" for sheet metal flashing and trim integral with metal wall panels.
3. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated 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. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

C. Preinstallation Conference: Conduct conference at Project site and in conjunction with preinstallation roofing conference.

1. Review methods and procedures related to sheet metal flashing and trim.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect sheet metal flashing.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 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 the extent necessary for the period of sheet metal flashing and trim installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which 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 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Recycled Content: Provide steel sheet with average recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

1. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft.: 208-lbf/sq. ft. perimeter uplift force, 312-lbf/sq. ft. corner uplift force, and 104-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 180 deg F, material surfaces.

1.4 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 manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.

C. Samples for Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. LEED Submittals: none required

E. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

2. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
3. Surface: Smooth, flat.
4. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 621. 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.

5. Color: As selected by Architect from manufacturer's full range.
6. Concealed Finish: Pretreat with 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.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and 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.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. 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.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the 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 without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed 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 as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" and by FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

J. Do not use graphite pencils to mark metal surfaces.

2.4 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide, joint cover plates.

1. Joint Style: Butt, with 12-inch- wide, concealed backup plate.
2. Fabricate from the following materials:

    a. Galvanized Steel: 24 gage thick.

2.5 FABRICATED FLASHING ASSEMBLIES

A. Grade Level Through Wall Masonry Flashing: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide, joint cover plates.

1. Components:

    a. Built-in formed receiver button punched to accept counterflashing
    b. Shaped counter flashing button bunched to lock into receiver.

2. Joint Style: Butt, with 12-inch minimum offset of components
3. Fabricate from the following materials:

    a. Stainless Steel: 26 gage thick, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions 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.

B. For the record, 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, 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, solder, welding rods, 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 and levels indicated. Provide uniform, neat seams with minimum exposure of 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. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

C. 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 watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, 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 moderate, 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 Division 07 Section "Joint Sealants."

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 16-inch centers.

3.4 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 as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 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 installation, remove unused materials and clean finished surfaces. Maintain in a 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

SECTION 077200

ROOF 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. This Section includes the following:

1. Roof hatches.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Division 05 Section "Pipe and Tube Railings" for safety railing system not attached to roof hatch curbs.
3. Division 06 Section "Rough Carpentry" for roof sheathing, wood cants, and wood nailers.
4. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

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, manufacturers listed in other Part 2 articles.

2.2 METAL MATERIALS

A. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coated and mill phosphatized for field painting.

B. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized to comply with ASTM A 123/A 123M, unless otherwise indicated.

C. Steel Tube: ASTM A 500, round tube, baked-enamel finished.

D. Galvanized Steel Tube: ASTM A 500, round tube, hot-dip galvanized to comply with ASTM A 123/A 123M.

E. Galvanized Steel Pipe: ASTM A 53/A 53M.

2.3 MISCELLANEOUS MATERIALS

A. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, 1 inch thick.

B. Glass-Fiber Board Insulation: ASTM C 726, 1 inch thick.

C. Polyisocyanurate Board Insulation: ASTM C 1289, 1 inch thick.

D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

2.4 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Available Manufacturers and Products:

    a. Bilco: Custom Sized, Type “NB”.

2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
3. Type and Size: Single-leaf lid, 36 by 64 inches.
4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch thick.

    a. Finish: Prime painted.

5. Insulation: Cellulosic-fiber, glass-fiber or polyisocyanurate board.
6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.
8. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
9. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
10. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

    a. Provide 2-point latch on covers larger than 84 inches.

B. Safety Rails: Provide railing system to protect open roof hatches. System to consist of non-penetrating bases with connecting rails and gate for open side. Provide rubber roof pads for bases. Provide system meeting OSHA Standards Nos. 1910.23 and 1926.500 – 1926.503.

1. Available Products:

    a. BlueWater Manufacturing (866-898-5237): SafetyRail 2000.
    b. Milcor: Safety Railing MRHSR-SS 3630

c. Bilco: Bil-Guard Hatch Railing System

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Hatch Installation:

1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
2. Attach safety railing system to roof hatch curb.
3. Attach ladder safety post according to manufacturer's written instructions.

F. Seal joints with elastomeric or butyl sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Division 09 painting Sections.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

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. This Section includes, unless specified elsewhere, through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Sections include the following:

1. Division 21 Sections specifying fire-suppression piping penetrations.
2. Division 22 and 23 Sections specifying duct and piping penetrations.
3. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop 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 construction penetrated.

1. Fire-resistance-rated walls including smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 3.0 cfm/sq. ft at both ambient temperatures and 400 deg F.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

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

B. LEED submittals: Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables.

b. Provide required documentation for all the above requirements to verify compliance.

C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

E. Qualification Data: For Installer.

F. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

G. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing through-penetration firestop 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 through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

        1) UL in its "Fire Resistance Directory."

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

D. 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.

E. 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 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days 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 by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include those systems indicated that are produced by one of the following manufacturers:

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 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:

    a. Slag-/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 after cure do not re-emulsify during exposure to moisture.

D. Elastomeric Spray: Single component, water-based elastomeric compound.

E. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

F. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

G. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

H. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

I. 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.

J. 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.

K. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

L. 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 other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

M. 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 through-penetration firestop system 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 work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system 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 through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. 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 through-penetration firestop 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 through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing 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 firestop systems.

C. Install fill materials for firestop systems 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop 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 openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system 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 through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

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. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 08 Section "Glazing" for glazing sealants.
3. Division 09 Section "Gypsum Board" for sealing perimeter joints.
4. Division 09 Section "Tiling" for sealing tile joints.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.
    a. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables.
    b. Provide required documentation to verify compliance

C. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

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.

E. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

G. Warranties: Sample of special warranties.

1.4 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. 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.

C. 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.

D. Preinstallation Conference: Conduct conference at Project site.

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.

1.6 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: Five 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: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 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 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 (EIFS): 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 (VOC 27).
c. Pecora Corporation; 890NST (VOC 98).
d. Sika Corporation, Construction Products Division; SikaSil-C990.
e. Tremco Incorporated; Spectrem 3 (VOC 18).

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).

2.3 LATEX JOINT SEALANTS

A. Sealant Type 5: 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.

    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.

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 Between EIFS 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 Doors, Windows and Elevator Entrances.

1. Latex Joint Sealant: Sealant Type 5.
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 Partitions.

1. Latex Joint Sealant: Sealant Type 5.
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 for Which No Other Sealant is Indicated.

1. Latex Joint Sealant: Sealant Type 5.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

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:

1. Standard hollow metal doors and frames.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material. Provide documentation to verify compliance.

D. Shop Drawings: Include the following:

1. Elevations of each door design.
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.

E. Other Action Submittals:

1. 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 door hardware schedule.

F. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies 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 or UL 10C.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are 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. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

E. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Doors: Provide doors as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Clear Width: 32 inches (815 mm) with door 90 degrees open.
b. Maneuvering Clearances: Refer to Code for various side and approach clearances.
c. Double-Leaf Doorways: Provide at least one leaf that meets the clear width and maneuvering clearances.
d. Two Doors in Series: Provide a distance of four feet plus the width of any door swinging into the space between hinged or pivoted doors.

2. Notify Architect of details or specifications not conforming to code.

F. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of 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 under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages 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.

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; a United Dominion Company.
b. Curries Company.
c. de La Fontaine, Industries.
d. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

1. Wipe Coat Galvanneal materials will not be considered acceptable.

E. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z 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.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. Powder-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.

H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

J. Glazing: Comply with requirements in Division 08 Section "Glazing."

K. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

1. Design: Flush panel.

2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

    a. Fire Door Core: As required to provide fire-protection ratings indicated.
    b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 10.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

        1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Beveled edge.

    a. Beveled Edge: 1/8 inch in 2 inches.

4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 (18 ga faces) and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 (18 ga faces) and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
4. Frames for Wood Doors: 0.053-inch- thick steel sheet.
5. Frames for Borrowed Lights: 0.053-inch- thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

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. 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, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 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 thickness of metal. 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. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Full hinge cut-outs for non-handed doors will not be acceptable.

D. 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight 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.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry 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) 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 1 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 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

c. 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.

7. Door Silencers: Except on weather-stripped doors, 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.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

G. Stops and Moldings: Provide stops and moldings around glazed lites 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 type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

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. 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. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

D. At exterior walls and masonry walls, coat inside of frame profile with bituminous coating to a thickness of 1/16 inch (1.5 mm).

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 ANSI/SDI A250.11.

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-protection-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 glazing 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 plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

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 powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Mineral Fiber Insulation: Fill head and jambs of frames scheduled to receive sound seals with mineral fiber insulation.
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 grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
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. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
8. 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 Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Division 08 Section "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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081400

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 flush wood doors with wood-veneer faces.

a. Factory finishing flush wood doors.
b. Factory fitting flush wood doors to frames and factory machining for hardware.
c. Factory glazing of flush wood doors.

2. Molded doors.
3. Exterior steel entry doors.
4. Sliding patio doors.

B. Related Sections:

1. Division 06 Section "Interior Finish Carpentry" for wood door frames.
2. Division 08 Section "Glazing" for glass view panels in flush wood doors.
3. Division 09 Sections "Exterior Painting" and "Interior Painting" for field finishing doors.

1.3 SUBMITTALS

A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.

B. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

C. LEED Submittals:

1. Product Data for Credit MR 2.1: Provide certifications for FSC Certified Tropical Wood if applicable.
2. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables. Provide documentation to verify compliance.

b. Provide verification from manufacturer that any composite material used in the products contains no added urea-formaldehyde resins.

c. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.

D. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

E. Samples for Selection: For factory-finished doors.

F. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body. Wood door distributor must be shown in chain-of-custody.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

D. Forest Certification: Provide doors made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

E. 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 positve pressure according to NFPA 252 and UL 10C.

1. Include all requirements as part of the door construction per Category “A” guidelines.”

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 PROJECT 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 the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which 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 Period for Solid-Core Interior Flush Wood Doors: Life of installation.
3. Warranty Period for Molded Interior Doors: One year 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. FSC-Certified Flush Wood Doors:

a. Algoma Hardwoods Inc.: Smartwood Environmentally Certified Doors.
b. Marshfield Door Systems, Inc.: Environmental Class Doors.

2. Molded Wood Doors:

a. Jeld-Wen.

3. Insulated Steel Entry Doors:

a. Therma-Tru.

4. Sliding Patio Doors:

a. Marvin.
b. Pella.

B. Provide FSC-Certified wood doors for non-fire rated and 20 minute fire-rated wood doors. Provide standard flush wood doors for fire rated doors over 20 minute rating.

2.2 FLUSH WOOD DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2 , made with binder containing no urea-formaldehyde resin.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

D. 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.

E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

F. 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 as needed 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.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade A faces.

2. Species: White maple.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Exposed Vertical Edges: Solid stock, same species as faces.
7. Core: Particleboard except where structural composite lumber is required.
8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
9. Adhesives: Type I per WDMA TM-6.
10. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Lipped tapered beads.
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.

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 requirements in NFPA 80 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, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.

D. Factory Glazing: Provide glazing for all doors. Provide glass as specified in Division 08 Section “Glazing.” Install fire-rated glass as required by the glazing manufacturer.

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. Finish doors at factory.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: WDMA TR-4 conversion varnish or TR-6 catalyzed polyurethane.
3. Staining: None required.
4. Effect: Open-grain finish.
5. Sheen: Satin.

2.7 INSULATED STEEL ENTRY DOORS

A. Entry Doors: 20 minute fire rated, door assembly including frame, hinges, threshold, weatherstripping, and prep for lockset.

1. Product: PS-210 Premium Series Steel Insulated Entry Door by Therma-Tru.

B. Refer to the Door Schedule for locations of door types.

C. Casing: As indicated on the drawings.

D. Weatherstripping: Manufacturer's standard.

2.8 MOLDED DOORS

A. Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:

1. Molded Doors: Pro-Core Cambridge by Jeld-Wen from Brosco.

B. Molded Doors: Solid core molded MDF.

2.9 SLIDING PATIO DOORS

A. Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:

1. Sliding Doors: Marvin, style to be determined.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that 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 Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors (molded doors): Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory-Fitted Doors (flush wood doors): Align in frames for uniform clearance at each edge.

E. 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

SECTION 083100 ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent, location, and size of each type of access door required are indicated on drawings and as specified herein. Provide access doors at all concealed valves, dampers, controls, etc. and where indicated.

1. Drawing Abbreviation: AP
   a. Size unless otherwise noted: 16” x 16”

1.03 QUALITY ASSURANCE:

A. Fire-Resistance Ratings: Wherever a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters Laboratories, Inc.; "Classified Building Materials Index" for rating shown.

1. Provide UL label on each fire-rated access door.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes indicated.

C. Coordination: Furnish inserts and anchoring devices which must be built into other work for installation of access doors.

1. Coordinate delivery with other work to avoid delay.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Subject to compliance with requirements, provide access doors by one of the following:

1. Milcor
2. J. L. Industries
3. Larsens
4. Architect approved equal.

2.02 MATERIALS AND FABRICATION:

A. General: Furnish each access door assembly manufactured as an integral unit, complete with all parts and ready for installation.

B. Steel Access Doors and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of support shown.

C. Frames: Fabricate from 16-gauge steel.

1. Fabricate frame with exposed flange approximately 1" wide around perimeter of frame for units installed in the following construction:

a. Exposed plaster over masonry.

D. Flush Panel Doors: Fabricate from not less than 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees. Finish with manufacturer's factory-applied prime paint.

1. For fire-rated units, provide manufacturer's standard insulated flush panel/doors, with continuous piano hinge and self-closing mechanism.

E. Locking Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with manufacturer's instructions for installation of access doors.

B. Coordinate installation with work of other trades.

C. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

D. Place so as to allow clear access to all items.

3.02 ADJUST AND CLEAN:

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames which are warped, bowed or otherwise damaged.

END OF SECTION

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 storefront framing.
2. Exterior manual-swing entrance doors and door-frame units.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Noise or vibration created by wind and by thermal and structural movements.
e. Loosening or weakening of fasteners, attachments, and other components.
f. Sealant failure.
g. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings..
2. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

    a. Component Importance Factor is 1.5.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite 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 L/360 of clear span or 1/8 inch, whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation 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.

    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. Interior Ambient-Air Temperature: 75 deg F.

I. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.40 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

    a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
    b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
    c. Low or No emissions of VOC: Provide sealant materials that comply with VOC limits in reference tables.
    d. Provide required documentation for all the above requirements to verify compliance.

C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the 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 systems 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. Detail fabrication and assembly of aluminum-framed systems.
2. Include design calculations.

G. Seismic Qualification Certificates: For aluminum-framed systems**,** accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

I. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

J. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Doors: Provide doors as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Clear Width: 32 inches (815 mm) with door 90 degrees open.
b. Maneuvering Clearances: Refer to Code for various side and approach clearances.
c. Double-Leaf Doorways: Provide at least one leaf that meets the clear width and maneuvering clearances.
d. Two Doors in Series: Provide a distance of four feet plus the width of any door swinging into the space between hinged or pivoted doors.

2. Notify Architect of details or specifications not conforming to code.

G. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review structural loading limitations.
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. Review use of Rivnuts for hardware.
5. Review sill flashing details and components.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems 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 caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water leakage through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide indicated products by one of the following:

1. EFCO Corporation.
2. Kawneer North America; an Alcoa company.
3. United States Aluminum.
4. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
5. YKK AP America Inc.

B. Products:

1. Exterior Aluminum-Framed Storefronts:

a. Kawneer: Trifab VG 451 T.
b. EFCO: System 403.
c. U.S. Aluminum: Series IT451.
d. Vistawall: 3000 Thermal MultiPlane.
e. YKK AP: YES 45 TU.

2. Doors and Entrances:

a. Kawneer: 350 Heavy Wall.
b. EFCO: Series D318 DuraStile.
c. U.S. Aluminum: Series 800 Durafront.
d. Vistawall: Rugged MS.
e. YKK AP: 40D HD Entrance Door.

2.2 MATERIALS

A. Recycled Content of Aluminum Products: Provide products with average recycled content of aluminum products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

C. 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.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-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: 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. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. 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 stainless steel.

D. 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.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Subsills for Exterior Storefronts: Manufacturer's standard thermally broken extruded aluminum sill flashing, color to match framing.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

A. Heavy-Duty Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-7/8 to 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.

    a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products or products equivalent in function and comparable in quality to named products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

    a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbfto set the door in motion and not more than 15 lbf to open the door to its minimum required width.
    b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

B. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless-steel pin.
3. Quantities:

a. For doors up to 87 inches high, provide 3 hinges per leaf.
b. For doors more than 87 and up to 120 inches high, provide 4 hinges per leaf.

C. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

D. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

E. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

F. Additional Hardware: As specified in Division 8 Section "Door Hardware."

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

1. Provide interior sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. 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. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. 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 doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

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.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.10 HARDWARE FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

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.

D. Provide the following finishes:

1.	Butts and Hinges:	26D
2.	Weatherstripping	Aluminum
3.	Threshold	Aluminum

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will 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 the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

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.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION

SECTION 085413 - FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following fiberglass framed window and door product types:

1. Single-hung windows.
2. Awning windows.
3. Fixed windows.

1.2 DEFINITIONS

A. C: Commercial.

B. HC: Heavy Commercial.

C. LC: Light Commercial.

D. R: Residential.

E. Performance grade number, included as part of the AAMA/WDMA product designation code, is actual design pressure in pounds force per square foot (pascals) used to determine structural test pressure and water test pressure.

F. Structural test pressure, for uniform load structural test, is equivalent to 150 percent of design pressure.

G. Minimum test size is smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

1. Minimum size required by AAMA/WDMA 101/I.S.2.
2. Minimum size required by gateway performance requirements for determining compliance with AAMA/WDMA 101/I.S.2 for both gateway performance requirements and optional performance grades.
3. Size indicated.

B. AAMA/WDMA Performance Requirements: Provide wood windows of the performance class and grade indicated that comply with AAMA/WDMA 101/I.S.2.

1. Performance Class and Grade:

    a. Single-Hung Windows: LC 30.
    b. Awning Windows: LC 50.
    c. Fixed Windows: LC 50.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

    a. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material. Provide documentation to verify compliance.

C. Provide required documentation for all the above requirements to verify compliance.

D. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Mullion details, including reinforcement and stiffeners.
2. Joinery details.
3. Expansion provisions.
4. Flashing and drainage details.
5. Weather-stripping details.
6. Thermal-break details.
7. Glazing details.
8. Window cleaning provisions.

E. Samples for Selection: Submit color samples with factory-applied color finishes.

F. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of wood window. Test results based on use of down-sized test units will not be accepted.

G. Maintenance Data: For operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain wood windows through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of wood windows and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Provide WDMA-certified wood windows with an attached label.

F. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

G. Mockups: Before installing window and door units, build mockups to demonstrate installation procedure. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockup of typical door installation.
2. Build mockup of typical window installation.
3. Coordinate the presence of Architect, Owner, window manufacturer representative, and air infiltration manufacturer representative.
4. Review, discuss, and coordinate the interrelationship of wood doors and windows with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.
5. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
6. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.
7. Approval of mockups is for relationship of door and window with air barrier installation; and aesthetic qualities of workmanship.
8. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Energy Ratings: Provide windows that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the Federal Trade Commission and Energy Star labels.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating wood windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Failure to meet performance requirements.
2. Structural failures including excessive deflection.
3. Water leakage, air infiltration, or condensation.
4. Faulty operation of movable sash and hardware.
5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
6. Insulting glass failure.

B. Warranty Period: 10 years from date of Substantial Completion.

C. Warranty Period for Glass: 20 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. Fiberglass Windows:

a. Integrity All-Ultrex Single-Hung Window from Marvin Windows and Doors.

2.2 MATERIALS, GENERAL

A. Fiberglass Pultrusions: Manufacturer's standard fiber reinforced material consisting of glass fibers and polyester resin pultruded into required hollow and channel shapes with factory applied finish.

1. Factory Finish: Manufacturer's standard impermeable finish.

a. Exterior Color: Color as selected by Architect from manufacturer's standard color range.
b. Interior Color: White.

B. Trim and Glazing Stops: Pultrusion material and finish to match clad frame members.

C. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action, and completely concealed when wood window is closed.

1. Weather-Stripping Material: Manufacturer's standard system and materials complying with AAMA/WDMA 101/I.S.2.

G. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.

1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.

H. Replaceable Weather Seals: Comply with AAMA 701/702.

2.3 GLAZING

A. Glass: Manufacturer's standard factory-glazing system of Clear, insulating-glass with low-e coating or film, argon-gas filled units. Tempered where required by Code.

2.4 HARDWARE

A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material; designed to smoothly operate, tightly close, and securely lock wood windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals. Where exposed, provide die-cast zinc with special coating finish.

B. Counterbalancing Mechanism: Comply with AAMA 902.

1. Sash-Balance Type: Concealed spring-loaded, block-and-tackle type of size and capacity to hold sash stationary at any open position.

C. Handles: Applied sash lift on bottom rail of forward placed operating sash; one per sash.

D. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.

2.5 INSECT SCREENS

A. General: Design windows and hardware to accommodate half-screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of double-hung windows.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Aluminum Tubular Framing Sections and Cross Braces: Roll-formed from aluminum sheet with minimum wall thickness as required for class indicated.
2. Finish: Baked-on organic coating in color selected by Architect from manufacturer's full range.

C. Glass-Fiber Mesh Fabric: 18-by-14 (1.4-by-1.8-mm) or 18-by-16 (1.4-by-1.6-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color. Comply with ASTM D 3656.

1. Mesh Color: Charcoal gray.

2.6 ACCESSORIES

A. Grilles and Simulated Divided Lites: Not required.

B. Strip Flashing: 30-mil-thick, self-adhering sheet consisting of Tyvek, and a premium butyl sealant laminated to a polyethylene film and release liner backing.

1. Product: DuPont StraightFlash and FlexWrap.

2.7 FABRICATION

A. General: Fabricate wood windows, in sizes indicated, that comply with AAMA/WDMA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring windows.

1. Provide windows sizes of standard available sizes without fabricating custom sizes, unless indicated otherwise. Provide windows with dimensions of not less than 2 inches smaller than indicated on the drawings or provide next size larger.

B. General: Fabricate wood windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/WDMA 101/I.S.2 performance requirements for the following window type and performance class. Include a complete system for assembling components and anchoring windows.

1. Fixed Windows: LC.
2. Awning Windows: LC.
3. Double-Hung Windows: LC.

C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.

1. Single-Hung Windows: Provide weather stripping only at horizontal rails of operable sash.

D. Factory machine windows for openings and hardware that is not surface applied.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches (2500 mm width plus length), glaze wood windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA 101/I.S.2.

G. Glazing Stops: Provide nailed or snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; and other conditions affecting performance of work.

1. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install membrane strip flashing in accordance with manufacturer’s recommendations and details on the drawings.

3.3 INSTALLATION

A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

3.4 ADJUSTING

A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085413

SECTION 087100

DOOR HARDWARE

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. Commercial door hardware for the following:

a. Swinging doors.
b. Other doors to the extent indicated.

B. Related Sections include the following:

1. Division 08 Section "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Division 08 Section "Wood Doors" for integral intumescent seals provided as part of fire-rated labeled assemblies.
3. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Cylinders for locks specified in the following other Sections:

a. Division 8 Section "Aluminum Entrances and Storefronts."

1.3 SUBMITTALS

A. General: Submittals for Sections 081113, 081416 and 087100 shall be made concurrently.

B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.

D. Product Certificates: For electrified door hardware, signed by product manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks and closers.

F. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

G. Warranty: Special warranty specified in this Section.

H. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    c. Content: Include the following information:

        1) Identification number, location, hand, fire rating, and material of each door and frame.
        2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
        3) Complete designations of every item required for each door or opening including name and manufacturer.
        4) Fastenings and other pertinent information.
        5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
        6) Explanation of abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for door hardware.
        8) Door and frame sizes and materials.
        9) List of related door devices specified in other Sections for each door and frame.

    d. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1. Installer's responsibilities include supplying door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

D. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Door Hardware: Provide hardware as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
b. Door Closers: Comply with the following maximum opening-force requirements indicated:

1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:

a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
b. Door Closers: Not more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
c. Thresholds: Not more than 1/2 inch high.

E. Fire-Rated Door Assemblies: For fire rated openings, provide hardware complying with NFPA 80 and NFPA 101 without exception. Provide only hardware tested by UL for the type and size of door installed and fire resistance rating required.

F. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
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. Review required testing, inspecting, and certifying procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.6 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.

b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion, except as follows:

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches.
2. Three Hinges: For doors with heights 61 to 90 inches.
3. Four Hinges: For doors with heights 91 to 120 inches.

4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Antifriction-bearing hinges and standard-weight hinges, as indicated.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Steel, with steel pin.
3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

E. Hinge Options: Where indicated in door hardware sets or on Drawings:

1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
2. Corners: Square.

F. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

2.3 HINGES

A. Butts and Hinges: BHMA A156.1.

B. Template Hinge Dimensions: BHMA A156.7.

C. Available Manufacturers:

1. Hager Companies (HAG).
2. McKinney Products Company; an ASSA ABLOY Group company (MCK).
3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

D. The following is a guide for hinge size and type required for this project.

	Manufacturer	Interior:	Exterior
1-3/8” Doors	Stanley	F179-3 1/2"	
up to 3’-0” wide	Hager	1279-3 1/2"	

	McKinney	T2714-3 1/2"	
1-3/4” Doors up to 3’-0” wide	Stanley	FBB179-4 1/2"	FBB191-4 1/2”
	Hager	BB1279-4 1/2"	BB1191-4 1/2"
	McKinney	TA-TB2714-4 1/2"	TA-TB2314-4 1/2"
1-3/4” Doors over 3’-0” wide	Stanley	FBB168-4 1/2"	FBB199-4 1/2”
	Hager	BB1168-4 1/2"	BB1199-4 1/2"
	McKinney	T4A-T4B3786-4 1/2"	T4A-T4B3386-4 1/2"

2.4 SPRING HINGES

A. Self-Closing Hinges: BHMA A156.17.

B. Spring Hinges: Provide Hager 1250 full mortised, spring hinge or approved substitute.

2.5 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Electrified Locking Devices: BHMA A156.25.

D. Lock Trim:

1. Levers: Cast.
2. Escutcheons (Roses): Forged.
3. Dummy Trim: Match lever lock trim and escutcheons.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

F. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

G. Backset: 2-3/4 inches, unless otherwise indicated.

H. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Mortise Locks and Latches: BHMA A156.13.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
5. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
6. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

2.6 MORTISED LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:

a. Best Lock Corporation (BLC).
b. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
d. Schlage Lock Company; an Ingersoll-Rand Company (SCH).

2. Electromagnetic Locks and Latches:

a. Locknetics Security Engineering; a Harrow Company (LSE).

3. Electromechanical Locks and Latches:

a. Best Lock Corporation (BLC).
b. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
d. Schlage Lock Company; an Ingersoll-Rand Company (SCH).

B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA Grade 1; Series 1000.

1. Provide one of the following manufacturers and designs:

a. Best H Series
b. Corbin/Russwin ML2000 Series
c. Sargent 8200 Series
d. Schlage L9000 Series

C. Lock Trim: Comply with the following:

1. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:

a. Best, 14 design
b. Corbin/Russwin, Newport design

c. Sargent, LNL design
d. Schlage, 06A design

D. Lock Functions: Lock functions as indicated in the hardware schedule shall be as follows:

FUNCTION	SARGENT	SCHLAGE	CORBIN/RUSSWIN	BEST
A (utility)	04	80	57	EW
B (office)	05	50	51	E
C (passage)	15	10	10	N
D (classroom)	37	70	55	J
E (entrance)	16	60	42	F
F (privacy)	65	40	30	LF

2.7 BORED LOCKS AND LATCHES (UNIT ENTRY DOORS)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:

a. Best Lock Corporation (BLC).
b. Corbin Russwin Architectural Hardware; Div. of Yale Security Inc. (CR).
c. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
d. Schlage Lock Company; an Ingersoll-Rand Company (SCH).

B. Bored Locks: BHMA Grade 1; Series 4000.

1. Provide one of the following manufacturers and designs:

a. Corbin Russwin: CL3300 Series.
b. Sargent: 10 Line
c. Schlage: D Series

C. Auxiliary Locks: BHMA Grade 1.

D. Lock Trim: Comply with the following:

1. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:

a. Corbin Russwin: NZD
b. Sargent: LL
c. Schlage: Rhodes

E. Lock Functions: Lock functions as indicated in the hardware schedule shall be as follows:

FUNCTION	SARGENT	SCHLAGE	CORBIN/RUSWIN
(1) (utility)	04	80	57

(2) (office)	05	53	51
(3) (passage)	15	10	10
(4) (classroom)	37	70	55
(5) (entrance)	16	60	72
(6) (privacy)	65	40	20

2.8 BORED LOCKS AND LATCHES (UNIT INTERIOR DOORS)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mechanical Locks and Latches:

a. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
b. Schlage Lock Company; an Ingersoll-Rand Company (SCH).

B. Bored Locks: BHMA Grade 2; Series 4000.

1. Provide one of the following manufacturers and designs:
a. Sargent: 7 Line
b. Schlage: S Series

C. Lock Trim: Comply with the following:

1. Lockset Designs: Provide the lockset design designated below or, if sets are provided by another manufacturer, provide designs that match those designated:

a. Sargent: LP
b. Schlage: Neptune

D. Lock Functions: Lock functions as indicated in the hardware schedule shall be as follows:

FUNCTION	SARGENT	SCHLAGE
(1) (utility)	04	80
(2) (office)	05	53
(3) (passage)	15	10
(4) (classroom)	37	70
(5) (entrance)	16	60
(6) (privacy)	65	40

2.9 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Precision Hardware, Inc. (PH).
2. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).
3. Von Duprin; an Ingersoll-Rand Company (VD).

B. Products: All exit devices for this project shall be one of the following:

1. Precision Olympian Series
2. The 80 Series exit device by Sargent & Co.
3. 98 Series by Von Duprin Division

C. Exit Devices: BHMA A156.3, Grade 1.

D. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

E. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

F. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

G. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

H. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.

I. Top and Bottom Strikes: Where vertical rod exit devices are indicated for interior doors, provide standard surface-mounted top strike and flush or recessed bottom strike.

J. The following functions shall be required where specified:

FUNCTION	VON DUPRIN	SARGENT	PRECISION
A	CD99NL-OP	16-8804	1103CD x 1123-38
B	CD99EO	16-8810	1101CD x 1123-38
C	99L	8813ET	1108 x 39L x 1123-38
D	99L-BE	8815ET	1108A x 39L x 1123-38
E	99EO-F	12-8810	FL-1101 x 1123-38
F	99L-F	12-8813ET	FL-1108 x 39L x 1123-38
G	99L-F-BE	12-8815ET	FL-1108A x 39L x 1123-38
H	CD9927EO	16-8710	1201CD x 1123-38
I	9927L	8713ET	1208 x 39L x 1123-38
J	9927L-BE	8715ET	1208A x 39L x 1123-38
K	CD9927EO x LBR	16-PP/PR8710	1201CD x 1123-38 x LBR
L	9927L x LBR	PP/PR8713ET	1208 x 39L x 1123-38 x LBR
M	9927L-BE x LBR	PP/PR8715ET	1208A x 39L x 1123-38 x LBR
N	9927EO-F	12-8710	FL-1201 x 1123-38

O	9927L-F	12-8713ET	FL-1208 x 39L x 1123-38
P	9927L-F-BE	12-8715ET	FL-1208A x 39L x 1123-38

2.10 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

C. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

    a. Replace construction cores with permanent cores as indicated in keying schedule.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders: Same manufacturer as for locks and latches.

2.11 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

1. Master Key System: Cylinders are operated by a change key and a master key.
2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

    a. Notation: Information to be furnished by Owner.

2. Quantity: In addition to one extra key blank for each lock, provide the following:

    a. Cylinder Change Keys: Three.
    b. Master Keys: Five.

2.12 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5, Grade 1; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

1. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

B. Cross-Index System: Multiple-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by key control manufacturer.

1. Available Manufacturers:

a. Key Control Systems, Inc. (KCS).
b. Telkee, Inc.; a division of Sunroc Corporation (SUN).

2.13 OPERATING TRIM

A. Standard: BHMA A156.6.

B. Materials: Fabricate from stainless steel, unless otherwise indicated.

C. Available Manufacturers:

1. Burns Manufacturing Incorporated (BM).
2. Don-Jo Mfg., Inc. (DJO).
3. Hager Companies (HAG).
4. IVES Hardware; an Ingersoll-Rand Company (IVS).
5. Rockwood Manufacturing Company (RM).

D. Door Pulls, 1 inch diameter.

1. Size: ADA compliant, unless indicated otherwise, provide 10 inches center to center, with 3 1/2 inch projection and 2 1/2 inch clearance.
2. Available Products:

a. Hager Companies, H4J.
b. IVES Hardware; an Ingersoll-Rand Company; 8103EZ.

2.14 CLOSERS

A. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Surface-Mounted Closers:

a. LCN Closers; an Ingersoll-Rand Company (LCN).
b. Sargent Manufacturing Company; Div. of ESSEX Industries, Inc. (SGT).

C. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

D. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. LCN:

a. Exterior: 4040 Series
b. Interior: 4040 Series

2. Sargent:

a. Exterior: 281
b. Interior: 281

F. Coordinators: BHMA A156.3.

2.15 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in door hardware sets.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:

1. Material: 0.050-inch- thick stainless steel.
2. Available Manufacturers:

a. Burns Manufacturing Incorporated (BM).
b. Don-Jo Mfg., Inc. (DJO).
c. Hager Companies (HAG).

d. IVES Hardware; an Ingersoll-Rand Company (IVS).
e. Rockwood Manufacturing Company (RM).

D. Fabricate protection plates as follows:

1. Push Plates: 16" high by 8" wide.
2. Kick Plates: 10" high by 1-1/2" less than door width for single doors and 1" less than door width for pairs of doors. Kick plates shall be applied to push side of all doors where noted.

2.16 STOPS AND HOLDERS

A. Wall Stops: Wall type bumpers with concealed type flange shall be used where ever possible and shall be Ives, No. 404 or equivalent by one of the following:
1. Door Controls
2. Rockwood

B. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.17 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame. Basis-of-Design Product, No. A626A by National Guard Products or approved substitute.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed. Basis-of-Design Product, No. 600A by National Guard Products or approved substitute.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed. Basis-of-Design Product, No. 95WH by National Guard Products or approved substitute.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on fire-rated doors and on smoke-labeled doors. Basis-of-Design Product, No. 5050 by National Guard Products or approved substitute.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

2.18 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.

D. Manufacturers:

1. T1: Provide No. 8425 by National Guard Products or approved substitute.
2. T2: Provide No. 896 with door bottom sweep No. 95WH by National Guard Products or approved substitute.

2.19 MISCELLANEOUS DOOR HARDWARE

A. Peep Holes: Provide one-way door viewer, No. 698 by Ives or approved substitute.

2.20 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Steel Machine or Wood Screws: For the following fire-rated applications:

a. Mortise hinges to doors.
b. Strike plates to frames.
c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

a. Surface hinges to doors.
b. Closers to doors and frames.
c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.21 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

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.

D. Provide the following finishes:

1.	Butts and Hinges:	26D
2.	Locks & Lock Trim:	26D
3.	Exit Devices:	32D
4.	Door Controls - Closers:	Sprayed Alum. Finish
5.	Mortise Locks & Latches:	26D
6.	Door Stops	26D/32D
7.	Weatherstripping	Aluminum
8.	Threshold	Aluminum
9.	Kickplates	32D
10.	Pulls	32D

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.

2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SETS

A. The hardware sets listed below indicate the items of hardware required for each opening. It is the bidder’s responsibility to accurately furnish the proper quantities, items, sizes, weights and functions as required by the plans and specifications. If an opening has, through error, been omitted from the following hardware sets, it shall be the bidder’s responsibility to supply hardware of equivalent quality and quantity, as that which is specified for a comparable opening.

UNIT ENTRANCE DOORS

HW1

Doors

1 - Hinge
2 - Spring Hinges
Lockset (entrance function)
Peephole (provide 1 peephole, additional peepholes where indicated)
Weatherstipping
Door bottom sweep
Threshold
Door stop

UNIT SINGLE CLOSET DOORS

HW2

Doors

Hinges
Lachset (passage function)
Door stop

UNIT DOUBLE CLOSET DOORS

HW3

Doors

Hinges
Pulls
Magnetic Catches

UNIT BATHROOM OR BEDROOM DOOR

HW4

Doors

Hinges
Lockset (privacy function)
Door stop

EXTERIOR PATIO DOOR

HW5 Hardware by door supplier

INTERIOR RATED EGRESS

HW6

Doors

Hinges
Closer
Exit Device (function F)
Door Stop

INTERIOR MECHANICAL, ELECTRICAL, UTILITY

HW7

Doors

Hinges
Closer
Lockset (function A)
Door Stop

SINGLE EXTERIOR ALUMINUM ENTRANCE DOORS

HW8

Doors

Closer (set for 120 degree opening)
Exit Device (function A)

Balance of hardware to be provided by aluminum door supplier

END OF SECTION

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. Storefront framing.

B. Related Sections:

1. Division 08 Section "Flush Wood Doors" for wood doors to be factory glazed.

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. Wind Design Data: As indicated on Drawings.

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 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. LEED Submittals: none required.

C. Glass Samples: For each type of the following products; 12 inches square.

1. Insulating glass.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Product Certificates: For glass and glazing products, from manufacturer.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass.

G. Warranties: Sample of special warranties.

1.6 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. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

E. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

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. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

1.7 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.

1.8 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.

1.9 WARRANTY

A. 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.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. 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 insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. 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.
3. 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.
4. 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).

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 and in "Insulating-Laminated-Glass Types" Article.

2.4 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies.

B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
b. Schott North America, Inc.; Laminated Pyran Crystal.
c. Vetrotech Saint-Gobain; SGG Keralite FR-L.

2.5 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. EPDM complying with ASTM C 864.
2. Silicone complying with ASTM C 1115.
3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned 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.

2.6 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. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. 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.

C. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.7 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.

2.8 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.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 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.

2.10 MONOLITHIC-GLASS TYPES

A. Tempered Glass: Clear fully tempered float glass.

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.
3. Application: Interior, non-fire rated glass.

2.11 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.

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 aluminum storefront and doors.

2.12 FIRE-PROTECTION-RATED GLAZING TYPES

A. Fire Glass: 45-minute, 60-minute, 90-minute fire-rated glazing; laminated ceramic glazing.

1. Provide safety glazing labeling.

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. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket 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. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. 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

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. This Section includes the following:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.

B. Related Sections include the following:

1. Division 06 Section "Rough Carpentry" for wood framing and furring that supports gypsum board.
2. Division 09 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

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

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables.
d. Provide documentation for all the above requirements to verify compliance.

1.4 QUALITY ASSURANCE

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.

C. Airtight Drywall Approach (ADA): Provide a continuous air barrier both between individual units and between the interior and exterior of building using the Airtight Drywall Approach (ADA) in order to minimize uncontrolled pathways for environmental tobacco smoke, airborne pollution, odors and air infiltration.
   1. Acceptable sealing of residential units shall be demonstrated by a Blower Door Test conducted in accordance with ANSI/ASTM 799, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization and should demonstrate less than 1.25 square inches leakage area per 100 square feet of enclosed area (i.e. Sum of wall, ceiling, and floor areas).

1.5 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT 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 interior products 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 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Recycled Content: Minimum 95 percent.

C. Provide product that is manufactured within 500 miles of project site.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

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. American Gypsum Co.
    b. BPB America Inc.
    c. G-P Gypsum.
    d. Lafarge North America Inc.
    e. National Gypsum Company.
    f. PABCO Gypsum.
    g. Temple.
    h. USG Corporation.

2. Provide USG products for higher recycled content or GP products manufactured at Newington, NH plant for regional materials.

B. Regular Type:

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

C. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Type: With 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.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material:

    a. Galvanized or aluminum-coated steel sheet or rolled zinc.
    b. Plastic 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.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper or 10-by-10 glass mesh.
2. Mold-Resistant Gypsum Wallboard: 10-by-10 glass mesh.

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.

2.5 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.
2. Recycled Content: Provide blankets with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 20 percent by weight.

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 Division 07 Section "Thermal Insulation."

F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

G. Firestopping: As specified in Division 07 Section “Penetration Firestopping.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

J. 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.

K. Fire-Resistance-Rated Gypsum Board Assemblies: Provide firestop 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. Regular Type: Vertical and ceiling surfaces, unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.
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 horizontally (perpendicular 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 1 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.

3.4 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.

3.5 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 those with trim having flanges not intended for 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.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

5. Level 5: Not required.

3.6 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.
    g. Implementation of all Airtight Drywall Approach procedures.

3.7 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, 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

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. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

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

B. 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 12-inch- long Samples of each type, finish, and color.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Provide required documentation for all the above requirements to verify compliance.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each acoustical panel ceiling.

E. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

    a. Smoke-Developed Index: 450 or less.

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with IBC 2006.

1.6 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.

1.7 PROJECT 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.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 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. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Recycled Content: Provide acoustical panels with recycled content such that preconsumer recycled content constitutes a minimum of 50 percent by weight.

B. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.

C. 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 per ASTM E 795.

D. 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.

E. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Where indicated, provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

F. Antimicrobial Fungicide Treatment: Where indicated, provide acoustical panels with face and back surfaces coated with antimicrobial treatment consisting of manufacturer's standard formulation with fungicide added to inhibit growth of mold and mildew and showing no mold or mildew growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

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.; Endura No. 638.

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.
2. Pattern: F (heavily textured).

C. Color: White.

D. LR: Not less than 0.84.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Angled tegular.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 24 inches.

J. Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

2.3 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.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, 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 per 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 per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. 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 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Hanger Rods or Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. 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.

G. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

H. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

I. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

J. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

1. Available Product: UHDC by Armstrong or L15 by USG.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

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.

2.5 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 circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per 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. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
5. 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.
6. 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.
7. 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 structure to which hangers are attached and 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.

8. When framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. 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.
10. 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.

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.

3.4 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.

3.5 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

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.

B. Related Sections:

1. Division 09 Section "Resilient Tile Flooring" for resilient floor tile.

1.3 SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables.
d. The product shall be certified by FloorScore program.
e. Provide documentation for all the above requirements to verify compliance.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

E. Product Schedule: For resilient products.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: 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.

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 PROJECT 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. 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.

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. 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.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong World Industries, Inc.

b. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
c. Endura Rubber Flooring; Division of Burke Industries, Inc.
d. Flexco, Inc.
e. Johnsonite.
f. Musson, R. C. Rubber Co.
g. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
h. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TP (rubber, thermoplastic).
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe). Straight (flat or toeless) at carpet.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Finish: Satin.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flexco, Inc.; Type 650 Square Nose.
b. Johnsonite; Heavy Duty Diamond (VIC).
c. Musson, R. C. Rubber Co.; No. GS 626VI.

B. Resilient Stair Treads Standard: ASTM F 2169.

1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Surface Design:

a. Class 1, Smooth (flat).
b. Class 2, Pattern: Raised-diamond design.

3. Manufacturing Method: Group 1, tread with embedded abrasive strips.

C. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.

D. Nosing Height: 1-1/2 inches.

E. Thickness: 1/4 inch and tapered to back edge.

F. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.

G. Risers: Smooth, flat, coved-toe, 7 inches high by length matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Thickness: 0.125 inch.

H. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

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. Johnsonite.

B. Material: Vinyl.

C. Profile and Dimensions:

1. Transition Strip between VCT and Carpet: CE-XX-A by Johnsonite or approved substitute.
2. Reducer Strip between Concrete and VCT: RRS-XX-C by Johnsonite or approved substitute.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

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. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

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.

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.

E. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

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.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SUBSTRATE TESTING

A. General: Conduct testing using an independent agency with a minimum of five years experience in moisture emission testing or as pre-approved by the manufacturer of the flooring material.

B. Moisture Emission Testing: Conduct moisture emission testing of concrete slabs-on-grade and elevated slabs to receive floor coverings or coatings by the calcium chloride test method. Perform tests in accordance with ASTM F-1869.

1. Conduct a minimum of three tests for the first 1,000 sq. ft. and one additional test for each additional 1,000 sq. ft.
2. Ambient test environment shall conform to ASTM-1869 and be reflective of the building's normal operational environment.
3. Conduct tests on bare concrete, free of surface contaminants, adhesives, curing compounds or sealers.
4. Locate test locations a minimum of five feet from exterior walls or interior walls that penetrate the floor. Do not conduct tests over random cracks or within five feet of control or construction joints.
5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

C. Internal Relative Humidity Testing: Conduct internal relative humidity testing of concrete slabs-on-grade and elevated slabs to receive floor coverings or coatings in accordance with ASTM F-2170.

1. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

D. Surface Alkalinity Testing: Conduct alkalinity testing of the concrete surface at all moisture emission test locations in accordance with ASTM F710 5.3.1.

E. Submit all test results to the Architect, flooring installer and manufacturer of the flooring materials before installation of the flooring materials.

3.3 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: 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 manufacturer. Do not use solvents.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.4 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 practicable 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. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.5 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 carpet and resilient floor covering that would otherwise be exposed.

3.6 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of 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 surfaces thoroughly.
3. Damp-mop 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. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply one coat.

E. Cover resilient products until Substantial Completion.

END OF SECTION

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. Rubber floor tile.
2. Vinyl composition floor tile.

B. Related Sections:

1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material.
c. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables.
d. The product shall be certified by FloorScore program.
e. Provide documentation for all the above requirements to verify compliance.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Product Schedule: For floor tile. Use same designations indicated on Drawings.

F. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 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 indicated.

B. Fire-Test-Response Characteristics: 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.

C. Preinstallation Conference: Conduct conference at Project site.

1. At least 7 days prior to starting installation of flooring, conduct a meeting to review detailed requirements for materials and to determine procedures for a satisfactory installation of flooring materials.
2. Review methods and procedures related to curing and protection of concrete substrate.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.5 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.

1.6 PROJECT 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. 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.

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. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 RUBBER FLOOR TILE

A. Products: Subject to compliance with requirements, provide one of the following:

1. Johnsonite; Diamond.
2. Musson, R. C. Rubber Co.; No. 624DL.

B. Tile Standard: ASTM F 1344, Class I-A, homogeneous rubber tile, solid color.

C. Hardness: Not less than 85 as required by ASTM F 1344, measured using Shore, Type A durometer per ASTM D 2240.

D. Wearing Surface: Molded pattern.

1. Molded-Pattern Figure: Raised diamonds.

E. Thickness: 0.125 inch.

F. Size: 18-1/8 by 18-1/8 inches or 24 by 24 inches.

G. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 VINYL COMPOSITION FLOOR TILE

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.; Excelon Stonetex.

B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch.

E. Size: 12 by 12 inches.

F. 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 manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

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. VCT Tile Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

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.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to 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 manufacturer. Do not use solvents.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 SUBSTRATE TESTING

A. General: Conduct testing using an independent agency with a minimum of five years experience in moisture emission testing or as pre-approved by the manufacturer of the flooring material.

B. Moisture Emission Testing: Conduct moisture emission testing of concrete slabs-on-grade and elevated slabs to receive floor coverings or coatings by the calcium chloride test method. Perform tests in accordance with ASTM F-1869.

1. Conduct a minimum of three tests for the first 1,000 sq. ft. and one additional test for each additional 1,000 sq. ft.
2. Ambient test environment shall conform to ASTM-1869 and be reflective of the building's normal operational environment.
3. Conduct tests on bare concrete, free of surface contaminants, adhesives, curing compounds or sealers.
4. Locate test locations a minimum of five feet from exterior walls or interior walls that penetrate the floor. Do not conduct tests over random cracks or within five feet of control or construction joints.
5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Internal Relative Humidity Testing: Conduct internal relative humidity testing of concrete slabs-on-grade and elevated slabs to receive floor coverings or coatings in accordance with ASTM F-2170.

1. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

D. Surface Alkalinity Testing: Conduct alkalinity testing of the concrete surface at all moisture emission test locations in accordance with ASTM F710 5.3.1.

E. Submit all test results to the Architect, flooring installer and manufacturer of the flooring materials before installation of the flooring materials.

3.4 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.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

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, nonstaining marking device.

G. 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.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of 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 products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply one coat.

E. Cover floor tile until Substantial Completion.

END OF SECTION

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. This Section includes the following:

1. Tufted carpet.
2. Carpet cushion.

B. Related Sections include the following:

1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

1.3 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.
2. Carpet Cushion: For each type indicated. Include manufacturer's written data on physical characteristics and durability.

B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch- square Sample.
2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.
3. Carpet Seam: 6-inch Sample.
4. Carpet Cushion: 6-inch- (150-mm-) square Sample.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home.
b. Provide material that has been certified by Carpet & Rug Institute (CRI) Green Label Plus program.
c. Recycled Content: Provide materials that include at least 25% postconsumer or 50% pre-consumer (postindustrial) recycled material.
d. Low or No emissions of VOC: Provide adhesive materials that comply with VOC limits in reference tables.
e. Provide required documentation for all the above to verify compliance.

D. Product Schedule: For carpet Use same designations indicated on Drawings.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

F. 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.

G. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Before installing carpet, build mockups to verify seam construction and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

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.

1.7 WARRANTY

A. Special Warranty for Carpet: Manufacturer's standard form in which 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.

B. Special Warranty for Carpet Cushion: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet cushion installation that fail in materials or workmanship within specified warranty period.

1. Warranty includes consequent removal and replacement of carpet and accessories.
2. Warranty does not include deterioration or failure of carpet cushion due to unusual traffic, failure of substrate, vandalism, or abuse.
3. Failure includes, but is not limited to, permanent indentation or compression.
4. Warranty Period: 10 years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, 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..

PART 2 - PRODUCTS

2.1 CARPET

A. Carpeting For Apartment Units: Broadloom carpeting by Shaw Contract Group.
1. Product: Revive Ecoworx Performance Broadloom 60679
2. Fiber: 100% Eco Solution Q Nylon
3. Backing: Ecoworx Performance Broadloom
4. Face Weight: 24 Oz.
5. Stretch-In installation at Suites G01, G02, 101, 102 201,202, 302, 303

6. Glue down installation at Suites 103, 203, 301

B. Carpeting For Corridors: Broadloom carpeting by Shaw Contract Group.
1. Product: Pebble 60687
2. Fiber: 100% Eco Solution Q Nylon
3. Backing: Ecoworx Performance Broadloom
4. Face Weight: 30 Oz.
5. Glue down installation

2.2 CARPET CUSHION

A. Polyurethane-Foam Cushion: Bonded.

1. Thickness: 3/8 inch.
2. Density: 5 lb/cu. ft.

B. Performance Characteristics: As follows:

1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
2. Environmental Requirements: Provide carpet cushion that complies with testing and product requirements of Carpet and Rug Institute's "Green Label" program.

2.3 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. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

D. 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.

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 cushion manufacturer.
2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Division 06 Section "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. 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 and carpet cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet and carpet cushion manufacturers' written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
2. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in 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.

1. Level adjoining border edges.

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.

H. Comply with carpet cushion manufacturer's written recommendations. Install carpet cushion seams at 90-degree angle with carpet seams.

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, "Protection of 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 and adhesive manufacturers.

END OF SECTION

SECTION 099113

EXTERIOR 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. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Galvanized metal.

B. This Section includes exposed exterior items and surfaces with low VOC coatings complying with ME DEP regulations.

C. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 08 Sections for factory priming doors with primers specified in this Section.
3. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

1.3 SUBMITTALS

A. Product List: For each product indicated, include the following:

1. Product data.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
4. Include printed statement of VOC content for each product.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. LEED Submittals: none required.

1.4 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.

1.5 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.

1.6 PROJECT 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 in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

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. Benjamin Moore & Co.
2. ICI Paints.
3. Sherwin-Williams Company (The).

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 Exterior 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. Wood Preservatives: VOC content of not more than 350 g/L.

C. Colors: Provide color selections made by the Architect. Allow for up to 3 different color selections.

2.3 METAL PRIMERS

A. Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04.
2. ICI: IMC 4020-1000 Devflex 4020PF DTM Primer & Flat Finish. (91 g/L)
3. Sherwin-Williams; IMC DTM Acrylic Primer/Finish, B66W1. (150 g/L)

B. Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Acrylic Metal Primer No. M04.
2. ICI: IMC 4020-1000 Devflex 4020PF DTM Primer & Flat Finish. (91 g/L)
3. Sherwin-Williams; IMC DTM Acrylic Primer/Finish, B66W1. (150 g/L)

2.4 EXTERIOR LATEX PAINTS

A. Exterior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic enamel for exterior application.

1. Benjamin Moore; DTM Acrylic Semi-Gloss Enamel M29: Applied at a dry film thickness of not less than 2.0 mils.
2. ICI Paint; IMC 4216-XXXX, High Performance Waterborne Acrylic Semi-Gloss Enamel. (225 g/L)
3. Sherwin-Williams; IMC DTM Acrylic Coating Semi-Gloss (Waterborne) B66W200 Series. (250 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 work.

B. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

C. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating 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 and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

E. 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.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Apply an additional coat of primer on metal surfaces that have been shop primed.

B. Tinting: Tint primer of colors such as reds, yellows, and oranges with a gray basecoat system designed to help provide color coverage.

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.

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 EXTERIOR 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 2.02.C of this Section.

B. Steel Substrates: Provide the following finish systems over exterior ferrous metal. Primer is required on shop-primed items.

1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

    a. Primer: Exterior ferrous-metal primer.
    b. Finish Coats: Exterior semi-gloss acrylic enamel.

C. Galvanized-Metal Substrates: Provide the following finish systems over exterior zinc-coated metal surfaces:

1. Semi-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

    a. Primer: Exterior galvanized metal primer.
    b. Finish Coats: Exterior semi-gloss acrylic enamel.

END OF SECTION

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. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete masonry units (CMU).
2. Steel.
3. Wood.
4. Gypsum board.
5. Cotton or canvas insulation covering.

B. This Section includes exposed interior items and surfaces with low VOC coatings complying with ME DEP regulations.

C. Related Sections include the following:

1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 08 Sections for factory priming doors with primers specified in this Section.
3. Division 09 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

1.3 SUBMITTALS

A. Product List: For each product indicated, include the following:

1. Product data.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
4. Include printed statement of VOC content for each product.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables. Provide required documentation to verify compliance.

1.4 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 benchmark samples 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. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 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.

1.6 PROJECT 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.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

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. Benjamin Moore & Co.
2. ICI Paints.
3. Sherwin-Williams Company (The).

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 and field applied 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 referenced tables of LEED for Homes program in Section 010100, whichever is stricter.
1.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.
b. Acrylonitrile.

c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Colors: Provide color selections made by the Architect. Allow for up to 10 different color selections.

2.3 BLOCK FILLERS

A. Latex Block Filler:

1. ICI: 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. ICI: Prep & Prime Odorless Primer-Sealer, LM9116. (0 g/L)
3. SW: ProGreen 200 Low VOC Interior Latex Primer B28W600 Series. (43 g/L)

B. High-Build Primer/Sealer:

1. Moore: Super Spec Satin-Fil 172 (VOC 31g/L)

C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. Rust-Inhibitive Primer (Water Based):

1. ICI: IMC 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. ICI:3210-1200 Prep & Prime Gripper Multi-Purpose Interior/Exterior Water-Based Primer Sealer. (99 g/L)
2. Moore: Super Spec Latex Enamel Undercoater & Primer Sealer #253.
3. S-W: PrepRite Classic Latex Primer B28W101 Series.

2.7 LATEX PAINTS

A. Low-VOC Latex (Flat):

1. ICI: Dulux® LifeMaster Flat Interior Latex Enamel 9100-XXX (0 g/L)
2. Moore: Pristine Eco Spec Interior Latex Flat, No. 219.
3. S-W: ProGreen 200 Interior Latex Flat, B30-600. (44 g/L)

B. Low-VOC Latex (Low Luster):

1. Moore: Pristine Eco Spec Interior Latex Eggshell, No. 223
2. ICI: Dulux® LifeMaster Eggshell Interior Latex Enamel 9300-XXX (0 g/L)
3. SW: ProGreen 200 Interior Latex Eg-Shel, B20-600. (40 g/L)

C. Low-VOC Latex (Semigloss):

1. Moore: Pristine Acrylic Semi-Gloss, No. 214
2. ICI: Dulux® LifeMaster Semi-Gloss Interior Latex Enamel 9200-XXX (0 g/L)
3. SW: ProGreen 200 Latex Semi-Gloss, B31-600. (46 g/L)

2.8 FLOOR COATINGS

A. Latex Floor and Porch Paint (Low-Luster):

1. Moore Latex Floor & Patio Enamel 122.
2. ICI: 3018-XXXX Groundworks 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 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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating 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 plates, machined surfaces, and similar items already in place that 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.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers 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. Concrete Masonry Substrates: Remove 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.

F. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

G. 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.

H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

I. 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.

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. Apply an additional coat of primer on metal surfaces that have been shop primed.

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 Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical, Plumbing and Fire Protection Work:

    a. Uninsulated metal piping.
    b. Uninsulated plastic piping.
    c. Pipe hangers and supports.
    d. Tanks that do not have factory-applied final finishes.
    e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
    f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

    a. Switchgear.
    b. Panelboards.
    c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

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, 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).

C. CMU and Concrete 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 low-luster paint.

D. 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.

E. Dressed Lumber Substrates:

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.

F. 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 at ceilings), (low sheen at walls) paint.

G. Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

1. Latex System:

    a. Prime Coat: Latex primer/sealer.
    b. Intermediate Coat: Latex paint matching topcoat.
    c. Topcoat: Latex flat paint.

END OF SECTION

SECTION 101400

SIGNS

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 signs:

1. Panel signs.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 01 Section "Temporary Facilities and Controls" for temporary project identification signs.
2. Division 32 Section "Site Improvements" for roadway signs and traffic signals.
3. Divisions 22 and 23 Sections for labels, tags, and nameplates for mechanical equipment.
4. Division 26 Sections for labels, tags, and nameplates for electrical equipment.
5. Division 26 Section "Interior Lighting Fixtures" for illuminated exit signs.
6. See Division 26 Sections for electrical service and connections for illuminated letters.

1.3 SUBMITTALS

A. Product Data: For each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for selection of color, pattern, and texture:

a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

1.4 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:

a. Illuminated Exit Signs: Refer to Division 26.
b. Elevator Signs: Refer to Division 14.
c. Stairway Identification:
d. Signs for Accessible Spaces:

1) Accessible entrances when not all are accessible (inaccessible entrances shall have directional signage to indicate the route to the nearest accessible entrance.
2) Accessible toilet and bathing facilities when not all are accessible.

2. Notify Architect of details or specifications not conforming to code.

D. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Manufacturers of Panel Signs:

a. Mohawk Sign Systems.

b. Welch Architectural Signage.

2.2 MATERIALS

A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:

1. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

B. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.3 PANEL SIGNS

A. Substrate: Fabricate signs from 1/8 inch thick matte clear acrylic with edges mechanically and smoothly finished to eliminate cut marks. Background color to be subsurface.
1. Background Color: As selected by the Architect from manufacturer’s standard colors.
2. Edge Condition: Straight.
3. Corner Condition: Rounded to 3/8 inch radius.
4. Size: 6 by 6 inch, unless noted otherwise.

B. Copy: Helvetica.

C. Letterform: route copy into face of substrate 1/32 inch deep. Chemically weld (inlay) computer precision cut tactile copy into routed letter openings so that tactile copy is embedded in substrate and remains at least 1/32” above surface of substrate.

1. Height: 5/8 inch minimum letter height.

D. Braille: Use engrave process for all Braille areas. Engrave Braille dots into surface of clear material.

E. Symbols of Accessibility:

1. Accessible elements: Provide international symbol of accessibility.
2. Elevators: Provide symbol containing person on stairs with flame.

F. Provide characters complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille.

2.4 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide

color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
2. Locate signs in accordance with approved shop drawings and ADA requirements.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.3 PANEL SIGN SCHEDULE

A.

Types:	Sizes:	Quantity:
Stairs	Provide 6" x 6"	one for each door to stair
Landings	Provide 6" x 6"	one for each landing
Corridors	Provide 6" x 6"	one for each entry
Exit	Provide 6" x 6"	one for each exit
Elevator	Provide 8" x 6" (In case of Fire Use Stairs)	one between each elevator at each floor

B. Provide the following sign to be located at roof hatch. “Close Roof Hatch When Working On Roof”

END OF SECTION

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. Toilet and bath accessories.

1.3 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. 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.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.5 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.

1.6 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 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:

1. Toilet and Bath Accessories:

a. Basco.
b. Franklin Brass.

B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Toilet and Bath Accessory Schedule at the end of Part 3.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. 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.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.3 TOILET AND BATH ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in this section or substitute product by approved substitution.

B. Toilet Tissue Dispenser: Where this designation is indicated, provide toilet tissue dispenser complying with the following:

1. Products: 308BPC by Franklin Brass.
2. Capacity: Designed for 4-1/2- or 5-inch- diameter-core tissue rolls.

C. Grab Bars: Where this designation is indicated, provide stainless-steel grab bar complying with the following:

1. Products: 5636PS and 5642PS by Franklin Brass.
2. Outside Diameter: 1-1/4 inches for medium-duty applications.

D. Towel Bars: Where this designation is indicated, provide stainless-steel grab bar complying with the following:

1. Products: 5800SF by Franklin Brass.
2. Outside Diameter: 1 inch.

E. Recessed Medicine Cabinet: Where this designation is indicated, provide the following:

1. Products: No. PE392P-W, 24x36 by Basco or approved substitute.

F. Surface-Mounted Medicine Cabinet: Where this designation is indicated, provide the following:

1. Products: No. SM PE392P-2W, 24x36 by Basco or approved substitute.

2.4 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

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 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.
2. Show location of knockouts for hose valves.

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.

D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 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.

1.5 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses, hose valves, and hose racks indicated are accommodated.

C. 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 1037F17.
2. Larsen's: Architectural Series SS 2409-6R.
3. Potter-Roemer: Alta Series 7062-A-2.

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. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim. Provide where indicated on the drawings.

G. Cabinet Trim Material: Stainless-steel sheet.

H. Door Material: Stainless-steel sheet.

I. Door Style: Fully glazed panel with frame.

J. Door Glazing: Clear tempered glass, 3 mm.

K. 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.

L. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:

a. Interior of cabinet and door.

2. Stainless Steel: No. 4.

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.

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: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

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 roughing-in for hose and cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

C. 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.

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

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 Sections:

1. Division 10 Section "Fire Extinguisher Cabinets."

1.3 SUBMITTALS

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

C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

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 FMG.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 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 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. 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.

B. 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.

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 and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 105500

POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Horizontal mailboxes.

1.2 SUBMITTALS

A. Product Data: For each type of postal specialty specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

1. Provide manufacturer's certification that equipment proposed complies with USPS regulations and has been approved by the Postmaster General.

B. Shop Drawings: For each type of postal specialty specified. Show details of fabrication and installation. Include plans, elevations, sections, and attachments to other work.

C. Samples for Verification: Full-size units of each type of exposed color and finish required for each type of postal specialty specified. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain mail chutes and receiving and collection boxes through one source from a single manufacturer to ensure that mail will flow without restriction from the chute into the box.

B. Where mail system is served by USPS, provide products approved by USPS.

C. Requirements of Regulatory Agencies: Comply with USPS requirements for construction and installation of units served by USPS.

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. Horizontal Mailboxes:

    a. American Device Manufacturing Company.
    b. Auth-Florence Manufacturing Company.
    c. Bommer Industries, Inc.
    d. Salsbury Industries.

2.2 METALS

A. Aluminum: Alloy and temper best suited for the intended use and finish indicated.

1. Plate and Sheet: ASTM B 209 (ASTM B 209M), mill finish, where not exposed.
2. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M).

2.3 HORIZONTAL MAILBOXES

A. General: General: Provide indoor horizontal style STD-4C complying with USPS Standard 4C specifications.

B. General: Provide horizontal style STD-4C in size required for each building. Location to be confirmed with Architect at time of installation. Provide shop drawings to show configuration for approval before order.

C. Front-Loading Door: Manufacturer's standard unit, braced and framed to hold box doors in master front. Construct with continuous stainless-steel piano hinge on one side and solid closure for back of mail compartments. Fabricate unit so door remains open while mail is deposited.

1. Locking: Construct mailboxes to receive locks provided by local postmaster for use by postal employees.
2. Locking: Cylinder lock with 2 keys, keyed to building keying system.

D. Mail Compartments and Wall Receptacles: Fabricate concealed components of units from manufacturer's standard aluminum or steel sheet. Equip each compartment to receive tenant's name card.

E. Compartment Doors and Trim: Fabricate doors and trim from extruded aluminum to suit type of installation and loading method.

1. Identification: Identification engraved into face of compartment door, as designated by Architect. For sorting, provide slots and clear plastic openings to receive tenants' name cards.
2. Locking: A 5-pin tumbler, cylinder lock capable of at least 1000 key changes, with 2 keys for each compartment door. Key each door differently and deliver keys to Owner with a record of each corresponding lock and key number.

F. Directory: Manufacturer's standard directory unit in size and location as indicated and of same materials and finish as box frames, unless otherwise indicated.

G. Aluminum Finish: Finish exposed-to-view surfaces as follows:

1. Satin aluminum, clear anodized.

2.4 KEY KEEPER

A. Recessed Key Keeper: Provide recessed-mounted key keeper matching material and finish of mailboxes prepared for Arrow lock to be installed by USPS. Provide key keeper made by manufacturer of installed mailboxes.

2.5 METAL FINISHES

A. Exposed Aluminum Finish: Manufacturer's standard matching the following BHMA finish code number, complying with ANSI/BHMA A156.18:

1. Satin Aluminum, Clear Anodized: BHMA Finish Code No. 628.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install postal specialties level and plumb, according to manufacturer's written instructions, roughing-in drawings, original design, and referenced standards.

1. Final acceptance depends on compliance with USPS requirements.

3.2 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure postal specialties are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 107300

TRANSLUCENT CANOPIES (ALTERNATE #2)

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. The General Conditions of the Contract, including Supplementary Conditions and Division 1 - General Requirements, apply to the work of this Section.

1.02 WORK INCLUDED:

A. Design, manufacture and installation of translucent insulating system. An assembly of extruded Nano-Cell polycarbonate glazing panels incorporated into a complete aluminum framed system that has been tested and warranted by the manufacturer as a single source system.

B. All anchors, brackets, and hardware attachments necessary to complete the specified structural assembly, weatherability and water-tightness performance requirements. All flashing up to but not penetrating adjoining work are also required as part of the system and shall be included.

C. Trained and factory authorized labor with supervision to complete the entire panel installation.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Structural Steel/Wood Framing/Concrete.
B. Curbs and supporting members.
C. Roofing.
D. Sheet Metal and Flashing.
E. Sealant.

1.04 QUALITY ASSURANCE

A. Skylight system must be evaluated and listed by recognized building code authorities: International Council Evaluation Service Inc (ICC-ES) and SBCCI - Public Safety Testing and Evaluation Services Inc.

B. Materials and Products shall be manufactured by a company continuously and regularly employed in the manufacture of skylights using polycarbonate (not glass) panel systems for a period of at least ten (10) years. Manufacturers shall provide a list of at least ten (10) projects having been in place a minimum of ten (10) years, with similar size, scope, climate and type.

C. Erection shall be by a factory-approved installer which has been in the business of erecting similar material for at least five (5) consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

D. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system, and will ensure that it fully meets all requirements of this specification.

E. APPROVED MANUFACTURERS:
All manufacturers acceptable for use on this project under this section must be approved prior to bid. Manufacturers must submit evidence of compliance with all performance criteria specified herein. This evidence must include proof of conformance and test reports as specified below. Any exceptions taken from this specification must be noted on the approval request. If no exceptions are noted and approval is given, product performance will be as specified. Should non-compliance be subsequently discovered, the previously given approval will be invalidated and use of the product on the project will be disallowed. Requests for approval, with all appropriate submittal data and samples must be received no less than 15 days prior to bid date. A list of all approved manufacturers and products will be issued by addendum. No other manufacturers will be acceptable. No verbal approval will be given.

1.05 SUBMITTALS:

A. Submit shop drawings and color samples in accordance with Division 1 requirements.

B. The manufacturer shall submit written guarantee accompanied by substantiating data, stating that the products to be furnished are in accordance with or exceed these specifications.

C. The manufacturer shall submit certified test reports made by an independent organization for each type and class of panel system. Reports shall verify that the material will meet all performance requirements of this specification. Previously completed test reports will be acceptable if they are current and indicative of products used on this project. Test reports required are:

1. Self Ignition Temperature (ASTM 1929-3)
2. Smoke Density (ASTM D-2843)
3. Burning Extent (ASTM D-635)
4. Interior Flame Spread (ASTM E-84)
5. Color Difference (ASTM D-2244-85)
6. Weathering (ASTM D-4364)
7. Yellowing Index (ASTM D-1925)
8. Weathering Evaluation before and after exposure to 300°F, 25 minutes include Light Transmission, Color Change, and Yellowing Index, per ASTM E-1175, ASTM D-2244 and ASTM D-1925 respectively.
9. Shatter Resistance (ASTM D-3841/SPI Method B)
10. Large Missile Test - Impact Resistance per SFBC PA 201-94
11. Insulation “U” Factor per NFRC100 test methods & procedures
12. Water Penetration (ASTM E-331)
13. Load Bearing Capability (ASTM E-330-97)
14. OSHA Life Safety Fall and Walk Through Protection for 300 lb. point load per STD 29 CFR 1910.23 (e)(8)
15. OSHA Life Safety STD 29 CFR - Impact loading by blunt object of 500 ft. lbs. per ASTM E-695-03

16. Performance of exterior windows, curtain walls when impacted by wind-borne debris per ASTM E 1996-02, Level D
17. IES LM-44-90 Testing for Total and Diffused Reflectometry (Diffused Light Transmission)

D. MAINTENANCE DATA: The manufacturer shall provide recommended maintenance procedures, schedule of maintenance and materials required or recommended for maintenance.

1.06 WARRANTY:

A. Provide a single source skylight / wall light / walkway / canopy system manufacturer warranty for glazing panels and framing system – third party warranty for glazing panels shall not be acceptable.

B. Provide manufacturer 10 year warranty to include:
1. Change in light transmission of no more than 6% per ASTM D-1003
2. No delamination of panel affecting appearance, performance or structural integrity of the panel or the system.
3. Thermal aging - the light transmission and the color shall not change after exposure to heat of 300⌖F for 25 minutes. (When measured per ASTM D-1003 and ASTM D-2244 respectively).

PART 2 PRODUCTS

2.01 TRANSLUCENT INSULATING INTERLOCKING NANO-CELL GLAZING TECHNOLOGY:

A. The design and performance criteria of this job are based on products manufactured by CPI

Daylighting, Inc., Phone: (800) 759-6985, Fax (847) 816-0425;

Website: www.cpidaylighting.com

And as locally represented by: Sky Systems, Plymouth, NH 603-536-5090

Substitute products must be proven equal and approved by addenda prior to the published bid date per specification section 1.04 E. Fiberglass skins are unacceptable.

2.02 TRANSLUCENT PANEL PERFORMANCE

A. Nano-Cell Panel Technology – Longevity and Resistance to Buckling and Pressure
1. Translucent Panels must be of Nano-Cell technology. Wide Cell technology (cell size exceeding 0.18”) shall not be acceptable.
2. The translucent panel shall include an integral extruded Nano-Cell structural core. The panel’s exterior skins shall be connected with supporting continuous ribs, perpendicular to the skins, at a spacing not to exceed 0.18” (truss-like construction). In addition, the space between the two exterior skins shall be divided by multiple parallel horizontal surfaces, at a spacing not to exceed 0.18”.

B. Appearance:
1. Panel assembly thickness shall be a minimum .63" (16mm) single panel with exposed interlocking 1.25" wide U battens.
2. Panel Width: Shall not exceed 2' to ensure best performance for wind uplift, vibration, oil canning and visual appearance. Panels over 2' wide will not be approved.
3. The panels shall be uniform in color with an integral Nano-Cell core. In a cross section, the core shall be constructed of Nano-Cell square cells not to exceed 0.18" x 0.18". The appearance should be equal to CPI's Pentaglas 16 Panel. Wide cell panel configurations greater than 0.18" by .018" shall not be accepted.

C. Thermal and solar performance:
1. Insulation Value ("U") per NFRC 100 test methods & procedures - 0.38
2. Light Transmission (L.T.%) _____ per ASTM E972, E1175 or D-1003
3. Solar Transmission (S.T.) _____ per ASTM E1084 at "normal" (90#) incidence angle.
4. Color: As chosen by Architect from manufacturer's standard colors.

D. Translucent Panel Joint System:
1. Panel shall be extruded in one single formable length. Maximum panel width shall not exceed 2'. Transverse connections are not acceptable.
2. The panels should be manufactured with grip-lock double tooth upstands that are integral to the unit. The upstands shall be 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seam is not acceptable.
3. The U or H battens shall have a grip-lock double tooth locking mechanism to ensure maximum uplift capability.
4. The metal retention clip shall be configured with a 0.4" wide top flange that extends continuously across the web from end to end and from side to side. To allow a safety factor, the clip must be tested to meet a wind uplift standard of 90 psf per ASTM E330-97.
5. The panel system U connection shall meet wind load performance requirements without deterioration after 100 months of Florida outdoor exposure. This performance must be demonstrated by providing independent lab comparison test reports for a weathered vs. a new panel assembly. As a standard for all systems, provide test reports for a 16mm panel assembly, 6' wide x 12' long that have been exposed to Florida weather conditions for 100 months per ASTM E-330-97 for loading, ASTM E 1886-97 for cycling and ASTM E-1996-02 for missile impact at design load of 70 PSF.
6. Water Penetration: No water penetration of the panel U / H joint connection length at test pressure of 10.0 PSF per ASTM E-331
7. Free movement of the panels shall be allowed to occur without damage to the weather tightness of the completed system.

E. Flammability

1. The exterior and interior faces shall be an approved light transmitting panel with a CC1 fire rating classification per ASTM D-635. Flame spread no greater than 25 per ASTM E-84. Smoke density no greater than 75 per ASTM D2843 and a minimum self-ignition temperature of 1000#F per ASTM 1929. The panel shall be self-extinguishing.
2. Interior flame spread classification of Class I per ASTM E84.

F. Impact Resistance - the panels shall pass the following tests:
1. ASTM D-3841/SPI - Impact and Shatter Resistance of 200 ft. lbs.

2. SFBC – PA 201-94, impact resistance of 350 ft. lbs.
3. ASTM E-1996-02 - Must comply with standard specification for performance of exterior windows or curtain walls when impacted by windborne debris at level D and after cyclic wind loading at the specified design load.

G. OSHA Life Safety Standards 29 CFR 1926.502 (i)(2) and 29 CFR 1910.23 (e)(8)
1. Panel assembly shall withstand impact loading by blunt object of 500 ft. lbs. per ASTM E695-03
2. Panel assembly shall withstand a 300 lb. point load at 5' span per OSHA standard 29CFR 1910 23e8.

H. Cyclic Wind Load – Translucent Panels shall be tested for cyclic wind loads and impact resistance per ASTM E 1886-97 and ASTM E 1996-02 at test load to verify the positive and negative design loads and level D impact.

J. Weatherability:
1. The light transmission as measured by ASTM D1003, shall not decrease more than 6% over 10 years, or after exposure to temperature of 300±F for 25 minutes (thermal aging).
2. The panel shall be tested by recognized laboratory for weathering evaluation per ASTM D4364-84 (EMMAQUA, UNBACKED), after exposure to minimum concentrated natural sunlight radiation of 56000 MJ/M^2 (1540 MJ/M^2 of UV, 200 – 385 N.M). The panel shall not change in color more than 4.0 units Delta E, 4.0 units Delta L and Delta B.
3. The panel shall not change color more than 4.0 units (DELTA-E by ASTM D2244) after 60 months outdoor weathering in Arizona determined by an average of at least two samples.
4. Thermal aging - the interior and exterior faces shall not change color in excess of 0.75 Delta E by ASTM D2244 and shall not darken more than 0.3 units (Delta L by ASTM D2244) and 0.2 units Delta Y (YI) by ASTM D1925 and shall not show cracking or crazing when exposed to 300±F for 25 minutes.
5. The faces shall not become readily detached when exposed to temp of 300±F and 0±F for 25 minutes.
6. Panels shall consist of a polycarbonate resin with a permanent, co-extruded, ultra-violet protective layer. Post-applied coating or films of dissimilar materials are unacceptable. Fiberglass skins are unacceptable.
7. UV Maintenance: The system shall require no scheduled re-coating to maintain its performance or for UV protection.
8. Panel shall be factory sealed at the sill to restrict dirt ingress.

L. The minimum ratio of the panel weight to the panel thickness should be:

For 0.63" thick Pentaglas 16 panel, 0.68 LB. per S.F.

2.04 METAL MATERIALS

A. Extruded Aluminum shall be ANSI/ASTM B221; 6063-T6: 6063-T5 or 6005-T5.

B. Flashing:
1) 5005 H34 aluminum 0.04" minimum thickness.
2) Sheet metal flashings/closures/claddings are to be furnished shop formed to profile - when lengths exceed 10 ft. in nominal 10-ft lengths. Field trimming of the flashing and field

forming the ends is necessary to suit as-built conditions. Sheet metal ends are to overlap at least 6-in. to 8-in., set in a full bed of sealant and riveted if required.

C. All Fasteners for aluminum framing to be stainless steel or cadmium plated steel, excluding the final fasteners to the building.

D. All exposed ALUMINUM FINISH shall be standard color Clear Anodize.

PART 3 EXECUTION

3.01 EXAMINATION

A. General Contractor to verify when structural support is ready to receive all work in this section and to convene a Pre-Installation Conference at least one week prior to commencing work of this Section. Attendance required of General Contractor, skylight installer and all parties directly affecting and effected by the work of this section.

B. All submitted opening sizes, dimensions and tolerances are to be field verified by general contractor unless otherwise stipulated.

C. Installer to examine area of installation to verify readiness of site conditions. Notify general contractor about any defects requiring correction. Do not work until conditions are satisfactory.

3.02 INSTALLATION

A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners and hardware for material attachments as specified.

B. Use methods of attachment to structure allowing sufficient adjustment to accommodate tolerances.

C. Remove all protective coverings on panels immediately after installation.

3.03 CLEANING

A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, clean wiping cloths.

B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use.

C. Installers shall leave panel system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

END OF SECTION

SECTION 108000

OTHER SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Knox box.
2. Interior bicycle racks.
3. Through-wall ventilators.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

PART 2 - PRODUCTS

2.1 KNOX BOX

A. Where indicated on the drawings, provide Series 3200 Lift-Off Door Model, recessed mounted with face flange key box by Knox Box. Constructed of 1/4 inch plate steel housing, 1/2 inch thick steel door with interior gasket seal. Box and lock to be UL Listed.

1. Dimensions: 7 inches wide by 7 inches high by 3-3/4 inches deep.
2. Capacity: Holds up to 10 keys and access cards in interior compartment.
3. Finish: Manufacturer’s standard finish.
4. Color: Aluminum.
5. Options:

    a. Recessed mounting kit.

2.2 INTERIOR BICYCLE RACK

A. Locking Bike Trac No. 6006 by Saris Cycling Group (saris.com) or approved substitute.

B. Unit is designed to allow the user to lock the front wheel and frame to the lock rod utilizing a U-lock or cable lock. (not included)

C. These are wall mounted at alternating heights. Each holds 1 bike. Mounting hardware not included - needs to be expansion bolted to concrete wall. Plan and interior elevations show 13 of them.

2.3 THROUGH-WALL VENTILATORS

A. Provide Fresh 80 Ventilator by Therma-Stor Products (800-533-7533) or approved substitute.

B. Unit is designed to be installed in the exterior wall with adjustable air flow, insulation to eliminate condensation and reduce sound penetration, and dust and insect filters.

C. Provide sheet waterproofing perimeter flashing between unit sleeve and exterior wall sheathing.

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.

3.2 ADJUSTING AND CLEANING

A. Adjust specialties for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

3.3 CLEANING

A. Clean surfaces prior to inspection. Replace damaged or defective items.

END OF SECTION

SECTION 113100

RESIDENTIAL APPLIANCES

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. Cooking appliances.
2. Refrigeration appliances.
3. Cleaning appliances.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

B. LEED Submittals: Product Data for Credit EA 1: Optimize Energy Performance for Mid-rise:

a. Provide Energy Star certified appliances where applicable. Proved required documentation to verify compliance.

C. Provide documentation for all the above requirements to verify compliance.

D. Product Schedule: For appliances. Use same designations indicated on Drawings.

E. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

F. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.5 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

B. Electric Range: Limited warranty including parts and labor for first year and parts thereafter for on-site service on surface-burner elements.

1. Warranty Period: Five years from date of Substantial Completion.

C. Refrigerator/Freezer, Sealed System: Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product.

1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.

D. Dishwasher: Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product.

1. Warranty Period for Deterioration of Tub and Metal Door Liner: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RANGES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. Amana; a division of Whirlpool Corporation.
2. KitchenAid; a division of Whirlpool Corporation.
3. LG Appliances.
4. Maytag; a division of Whirlpool Corporation.
5. Sears Brands LLC (Kenmore).
6. Sharp Electronics Corp.
7. Whirlpool Corporation.

B. Electric Range (Standard Living Units): Freestanding range with one oven and complying with AHAM ER-1.

1. Basis-of-Design Product: General Electric JBS07HWW.

2. Width: 30 inches.
3. Electric Burner Elements: Four.

    a. Coil Type: Manufacturer's standard.
    b. Controls: Digital panel controls, located on splash panel at rear of rangetop.

4. Oven Features:

    a. Operation: Baking.
    b. Broiler: Located in top of oven.
    c. Oven Door: Counterbalanced, removable, with observation window and full-width handle.
    d. Electric Power Rating:

        1) Oven: Manufacturer's standard.
        2) Broiler: Manufacturer's standard.

    e. Controls: Digital panel controls and timer display, located on splash panel at rear of rangetop.

5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.
7. Material: Porcelain-enameled steel with manufacturer's standard cooktop.

    a. Color/Finish: White.

C. Electric Range (ADA Living Units): Drop-in range with one oven and complying with AHAM ER-1.

1. Basis-of-Design Product: General Electric JDP39WWWW.
2. Width: 30 inches.
3. Electric Burner Elements: Four.

    a. Coil Type: Manufacturer's standard.
    b. Controls: Digital panel controls, located on front of rangetop.

4. Oven Features:

    a. Operation: Baking.
    b. Broiler: Located in top of oven.
    c. Oven Door: Counterbalanced, removable, with observation window and full-width handle.
    d. Electric Power Rating:

        1) Oven: Manufacturer's standard.
        2) Broiler: Manufacturer's standard.

    e. Controls: Digital panel controls and timer display, located on front of rangetop.

5. Anti-Tip Device: Manufacturer's standard.
6. Electric Power Supply: 240 V, 60 Hz, 1 phase, 30 A.

7. Material: Porcelain-enameled steel with manufacturer's standard cooktop.

    a. Color/Finish: White.

2.2 REFRIGERATOR/FREEZERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. Amana; a division of Whirlpool Corporation.
2. KitchenAid; a division of Whirlpool Corporation.
3. LG Appliances.
4. Maytag; a division of Whirlpool Corporation.
5. Sears Brands LLC (Kenmore).
6. Sharp Electronics Corp.
7. Whirlpool Corporation.

B. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1.

1. Basis-of-Design Product: General Electric: GTH16BBSRWW.
2. Type: Freestanding.
3. Dimensions:

    a. Width: 28 inches.
    b. Depth: 31 inches.
    c. Height: 61-3/4 inches.

4. Storage Capacity:

    a. Refrigeration Compartment Volume: 15.5 cu. ft..
    b. Freezer Volume: 4.10 cu. ft..
    c. Shelf Area: Three adjustable glass shelves, 21.9 sq. ft..

5. General Features:

    a. Dual refrigeration systems.
    b. Separate temperature controls for each compartment.

6. Refrigerator Features:

    a. Interior light in refrigeration compartment.
    b. Compartment Storage: Vegetable crisper, utility bin and dairy compartment.
    c. Door Storage: Two fixed shelves with gallon milk-container storage.

7. Freezer Features: One freezer compartment with door.

    a. Automatic defrost.
    b. Interior light in freezer compartment.

8. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
9. Front Panel: Manufacturer's standard.

    a. Panel Color: White.

10. Appliance Color/Finish: White.

2.3 DISHWASHERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. Amana; a division of Whirlpool Corporation.
2. KitchenAid; a division of Whirlpool Corporation.
3. LG Appliances.
4. Maytag; a division of Whirlpool Corporation.
5. Sears Brands LLC (Kenmore).
6. Sharp Electronics Corp.
7. Whirlpool Corporation.

B. Dishwasher (Standard Living Units): Complying with AHAM DW-1 and ASSE 1006.

1. Basis-of-Design Product: General Electric: Model GSD1300NWW.
2. Type: Built-in undercounter.
3. Dimensions:

    a. Width: 24 inches.
    b. Depth: 23 inches.
    c. Height: 34-1/2 inches.

4. Tub and Door Liner: Porcelain-enameled steel with sealed detergent and automatic rinsing-aid dispensers.
5. Rack System: PVC-coated sliding dish racks, with removable cutlery basket.
6. Controls: Touch-pad controls with five wash cycles and hot-air and heat-off drying cycle options.
7. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
8. Front Panel: Manufacturer's standard.

    a. Panel Color: White.

9. Appliance Color/Finish: White.

C. Dishwasher (ADA Living Units): Complying with AHAM DW-1 and ASSE 1006.

1. Basis-of-Design Product: Asko, D3112.
2. Type: Built-in undercounter.
3. Dimensions:

a. Width: 24 inches.
b. Depth: 23 inches.
c. Height: 32-1/2 inches.

4. Tub and Door Liner: Stainless steel with sealed detergent and automatic rinsing-aid dispensers.
5. Rack System: Nylon-coated sliding dish racks, with removable cutlery basket.
6. Controls: Touch-pad controls with five wash cycles and hot-air and heat-off drying cycle options.
7. Energy Performance, ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
8. Front Panel: Manufacturer's standard.

   a. Panel Color: White.

9. Appliance Color/Finish: White.

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance 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 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

E. Utilities: See Divisions 22 and 26 for plumbing and electrical requirements.

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 visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

C. An appliance 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 residential appliances.

END OF SECTION

SECTION 122113 HORIZONTAL BLINDS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS The General Conditions, Supplementary General Conditions and all Sections of Division 1 shall apply to each and every contract and contractor, person or persons supplying material, labor or entering into the work directly or indirectly.

1.2 SCOPE This section includes all labor, materials, equipment and related services necessary for the fabrication, delivery and installation of the work shown on the drawings and or specified herein, including but not limited to the following:

A. Metal horizontal louver blinds at dwelling unit windows.
   1. Window treatment for corridor and stairway windows is not included.

1.3 QUALITY ASSURANCE; SUBMITTALS:

A. Comply with requirements of SECTION 013300 – SUBMITTAL PROCEDURES.

B. Code Compliance: Provide flame proof shades complying with NFPA 101.

C. Quality Assurance: Provide complete assemblies produced by one manufacturer for each type required including hardware, accessory items, mounting brackets, and fastenings.

D. Submittals: In addition to manufacturer's product data and installation instructions, submit following:
   1. Product data, including catalog cuts and ratings.
   2. Shop drawings for installations not fully detailed in product data.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Fabrication: fabricate units to completely fill the openings as indicated, from head to sill and jamb to jamb. For continuous window wall installations, fabricate units so that ends occur only over mullions or other defined vertical separations, unless otherwise indicated.

B. Colors: As shown or as selected by Architect from manufacturer's standards.

2.2 HORIZONTAL BLINDS

A. General: Provide manufacturer's standard vertical lifting and horizontal tilting unit complete with headrail, bottom rail, slats and accessories.

B. Product: Levelor Lorentzen Riviera Blinds, modified as specified; or approved equal by one of following:
   1. Hunter Douglas, Inc.
   2. Marathon Carey-McFall Div., Marathon Mfg. Co.

C. Headrail: Formed from sheet steel, minimum, 0.025” thick, into channel shaped sections housing tilting mechanism; with top and end braces, top cradles, cord lock and required accessories; finished to match slats.

D. Bottom Rail: Formed from steel sheet into tubular shape, with end caps, finished to match slats.

E. Aluminum Slats: Formed from spring tempered aluminum 0.10” thick, with manufacturer’s standard baked enamel finish, as follows:
   1. Slat Width: 1” narrow slats, with other components sized to suit.
   2. Slat Type: Non-perforated.

F. Ladders: Braided polyester cord design with integrally braided ladder rungs.

G. Tilting mechanism to hold tilting rod, slats and bottom rail at any set angle, wand operated.
   1. Provide wands of clear or neutral color to harmonize with blinds.
   2. Provide wands at high windows to extend to approximately 10’ above finish floor, with special end to accommodate operation by wand extension handle.
      a. Provide standard length wands, with special end, for windows above folding bleachers.
      b. Furnish to Owner, and obtain signed receipt therefore, extension handles to suit each high window condition.

H. Lifting Mechanism: Provide crash proof cord locks with cord separators, braided polyester or nylon lift cords, and cord equalizers.
   1. Adjust cords of high windows so that bottoms are approximately 10 feet above finish floor, except for low windows above bleachers.

I. Installation Brackets: Provide mounting hardware as recommended by manufacturer for installation indicated.

J. Operation to provide full tilting slats rotating approximately 180° with operating controls on left side; full height raising with lifting cord locks and cords on right hand side of units unless otherwise indicated.

K. Finish: Manufacturer’s standard baked on synthetic enamel finish.

2.4 FABRICATION AND OPERATION:

A. Prior to fabrication, verify actual opening dimensions by accurate site measurements. Adjust dimensions for proper fit at openings. Cooperate with other trades for securing tracks to substrates and other finished surfaces.

B. Fabricate window treatment components from non-corrosive, non-staining, non-fading materials which are completely compatible with each other, and which do not require lubrication during normal expected life.

C. Fabricate blind units to completely fill the openings as shown, from head-to-sill and jamb-to jamb.

D. For continuous window wall installation, fabricate blinds so that ends occur only over mullions or other defined vertical separation, unless otherwise indicated.

1. Provide multiple blinds for multiple windows, i.e. 2 windows, 2 blinds; 3 windows, 3 blinds, etc.

E. Space slats to provide overlap for light exclusion when in fully closed position.

F. Equip vertical blind units, unless otherwise indicated for the following operation:

1. Full-tilting operation with slat rotating approximately 180 degrees. Place tilt operating controls on left- hand side of blind units, unless otherwise indicated.

2. Full-width sliding, to manufacturer's minimum stacking dimension, with sliding cord locks for stopping blind at any point of travel. Place pull cords on right-hand side of blind units, unless otherwise indicated.

PART 3 - EXECUTION

3.1 SITE VERIFICATION: Verify opening dimensions and conditions in field.

3.2 INSTALLATION: Install units to comply with manufacturer’s instructions for the type of mountings and operations required. Position units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

A. Install window treatment units in manner indicated to comply with manufacturer's instructions. Position units level, plumb, secure, at proper height and location relative to adjoining window units and other related work. Securely anchor units with proper clips, brackets, anchorages, suited to type of mounting indicated.

B. Provide adequate clearance between sash and blind to permit unencumbered operation of sash hardware.

C. Divisions between blinds are permitted only at mullions by continuous windows or openings where more than one blind for one opening occurs, unless otherwise indicated.

D. Isolate metal parts from concrete and mortar to prevent galvanic action. Use tape or thick coating or other means recommended by manufacturer to effect separation.

E. Protect installed units to ensure their being in operating condition, without damage, blemishes, or indication of use at completion of project. Repair or replace damaged units as directed by Architect.

3.3 CLEAN/ADJUST:

A. Remove dirt, finger marks and other defacement from shades, blinds and accessories.

END OF SECTION

SECTION 122116 VERTICAL BLINDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. The extent of window treatment is indicated herein. Types of window treatment work in this section include:

1. Vertical PVC blinds at exterior sliding glass doors.

1.03 QUALITY ASSURANCE:

A. Provide window treatment units which are complete assemblies produced by one manufacturer for each type required, including hardware, accessory items, mounting brackets, and fastenings.

B. Provide materials in colors and patterns (if any) as indicated, or, if not indicated, as selected by Architect from manufacturer's standard colors/patterns.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of window treatment unit required. Include methods of installation for each type of opening and supporting structure.

B. Samples: For initial selection of colors, submit manufacturer's color charts consisting of sections of exposed components with integral or applied finishes showing full range of colors, materials, etc. available for each type of window treatment assembly required.

PART 2 - PRODUCTS

2.01 VERTICAL BLINDS:

A. Headrail: Manufacturer's standard headrail consisting of channel-shaped section fabricated from minimum 0.025" thick steel or aluminum with rolled edges at top. Increase metal thickness as recommended by manufacturer for large blind units. Furnish complete with tilting mechanism, top and end braces, top cradles, cord lock, and accessory items required for type of blind and installation indicated.

B. Louver Slats: Manufacturer's standard, polyvinylchloride curved solid slats, 0.028" thick, (louver blades). with rounded corners and forming burrs removed:

1. Slat Width: 3 1/2" slats, with other components sized to suit.

C. Rotation of Louver Vanes: Provide 180° rotation through sprocket providing 10-1 mechanical advantage. Provide manufacturer's standard (min. #6) corrosion resistant nickel plated bean chain with stops to prevent complete rotation.

D. Traversing: Provide side pull operation with a lock nit polyester chord which is stretch resistant, non-fraying and lint free. Provide end caps and traversing mechanism which lead chord through carrier trucks away from gears.

E. Installation Brackets: Manufacturer's standard brackets designed to facilitate removal of head channels. Provide intermediate brackets at spacing recommended by blind manufacturer. Include hardware necessary for secure attachment of brackets to adjoining construction and head rails. Design brackets to support safely the weight of blind assemblies plus forces applied to operated blinds.

F. Finish: Provide finishes indicated below. Finish exposed accessories and hardware to match rail color. Provide manufacturer's standard corrosion resistant finish to concealed items of hardware.

1. PVC slats: Provide manufacturer's standard factory finish system.

2. Headrail System: Clear anodized aluminum.

G. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Hunter Douglas, Inc.

2. Levelor Lorentzen, Inc.

3. Louver Drape

4. Architect approved equal.

2.02 FABRICATION AND OPERATION:

A. Prior to fabrication, verify actual opening dimensions by accurate site measurements. Adjust dimensions for proper fit at openings. Cooperate with other trades for securing tracks to substrates and other finished surfaces.

B. Fabricate window treatment components from non-corrosive, non-staining, non-fading materials which are completely compatible with each other, and which do not require lubrication during normal expected life.

C. Fabricate blind units to completely fill the openings as shown, from head-to-sill and jamb-to jamb.

D. For continuous window wall installation, fabricate blinds so that ends occur only over mullions or other defined vertical separation, unless otherwise indicated.

1. Provide multiple blinds for multiple windows, i.e. 2 windows, 2 blinds; 3 windows, 3 blinds, etc.

E. Space slats to provide overlap for light exclusion when in fully closed position.

F. Equip vertical blind units, unless otherwise indicated for the following operation:

1. Full-tilting operation with slat rotating approximately 180 degrees. Place tilt operating controls on left- hand side of blind units, unless otherwise indicated.

2. Full-width sliding, to manufacturer's minimum stacking dimension, with sliding cord locks for stopping blind at any point of travel. Place pull cords on right-hand side of blind units, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install window treatment units in manner indicated to comply with manufacturer's instructions. Position units level, plumb, secure, at proper height and location relative to adjoining window units and other related work. Securely anchor units with proper clips, brackets, anchorages, suited to type of mounting indicated.

B. Provide adequate clearance between sash and blind to permit unencumbered operation of sash hardware.

C. Divisions between blinds are permitted only at mullions by continuous windows or openings where more than one blind for one opening occurs, unless otherwise indicated.

D. Isolate metal parts from concrete and mortar to prevent galvanic action. Use tape or thick coating or other means recommended by manufacturer to effect separation.

E. Protect installed units to ensure their being in operating condition, without damage, blemishes, or indication of use at completion of project. Repair or replace damaged units as directed by Architect.

END OF SECTION

SECTION 122216 DRAPERY TRACK AND ACCESSORIES (Alternate #4)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes mounting and installation hardware for draperies and curtains, at exterior sliding glass doors.

1.02 SUBMITTALS

A. Submit in accordance with Section 013000, manufacturer's product data for each type of hardware specified, including installation and maintenance instructions.

B. Shop drawings showing location and extent of wind9w treatment hardware, including headings and anchorage details. Show relationship to adjoining work. Indicate location of operating controls.

C. Samples for verification purposes of each type of hardware indicated in sets for each color specified, showing full range of variations expected in these characteristics. Prepare samples from same material to be used for the Work.
   1. Window Treatment Track: 18-inch-long sample including end of track with operating hardware.

D. Hardware maintenance data to include in "Operating and Maintenance Manual" specified in Division 1.

1.03 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain hardware from one source of a single manufacturer.

1.04 PROJECT CONDITIONS

A. Field Measurements: Check openings by field measurements before fabrication; show recorded measurements on shop drawings.

1.05 EXTRA MATERIALS

A. Extra Materials: Furnished from same production run as hardware installed. Package materials with protective covering and identify with labels describing contents. Deliver extra materials to Owner.

   1. Track, Carriers, and Operating Devices: Furnish quantity of full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide

products by one of the following:
1. Kirsch.
2. Silent Gliss.

2.02 WINDOW TREATMENT HARDWARE

A. Track: Extruded aluminum, slotted not more than 16 inches on center for mounting. Size track for span and weight of window treatment indicated.

B. Track Mounting: Provide manufacturer's standard mounting brackets or channels designed to support the weight of the track assembly and window treatment plus force applied to operate window treatment.

1. Track Mount: As indicated.

C. Operation:

As follows:
1. Baton.
2. Draw: Two-way.

D. Carriers: Manufacturer's standard, sized for span and weight of window treatment indicated.

1. Master Carriers: Butt.

E. Installation Fasteners: Not less than two fasteners per bracket1 fabricated from metal noncorrosive to track hardware and adjoining construction and to support track and window treatment units under conditions of normal use.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings where track is to be installed for suitable conditions.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install window treatment hardware according to the manufacturer's instructions. Install track plumb and level, and at the proper height and location to adjoining window units. Securely anchor with clips, brackets, and anchors suited to the type of mounting indicated.

B. Isolate metal parts of window treatment hardware from concrete or mortar to prevent galvanic action. Use tape, thick coating, or another method, as recommended by the manufacturers.

3.03 ADJUSTING

A. Test operation of each unit to ensure unencumbered operation. Adjust units that do not operate smoothly.

3.04 CLEANING

A. Remove and dispose of debris, cartons, and other materials used in the installation.

3.05 PROTECTION

A. Protect installed units to ensure optimum operating conditions without damage at completion of the Project. Repair or replace damaged or malfunctioning units.

END OF SECTION

SECTION 122413

ROLLER SHADES (Alternate #4)

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 roller shades and curtain rods for exterior dwelling unit windows.
   1. Window treatment for corridor and stair windows is not included.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

C. Samples for Selection: For each colored component of each type of roller shade indicated.

   1. Include similar Samples of accessories involving color selection.

D. Window Treatment Schedule: Include roller shades in schedule using same room designations indicated on Drawings.

E. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

   1. Methods for maintaining roller shades and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
   3. Operating hardware.

PART 2 - PRODUCTS

2.1 ROOM DARKENING SHADES

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. C-Mor.
2. Colony - Colonial Glass.

B. Shade Band Material: Heavy duty reinforced vinyl.

1. Material Width: As required.
2. Bottom Hem: Straight.
3. Material Color: As selected by Architect from manufacturer's full range.

C. Construction: Commercial grade, with spring loaded wood rollers, tailored bottom hem with concealed weight and slip on plastic shade pull.

D. Direction of Roll: Regular, from back of roller.

E. Mounting Brackets: Galvanized or zinc-plated steel. Provide bracket without valance support.

F. Shade Operation: Manual; with 2 foot long pull cords with ring handle.

2.2 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows:

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch (6 mm) from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

C. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.

D. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

2.3 CURTAIN RODS

A. Provide one standard extendable U-shaped metal curtain rod for each window in Living Units. Provide proper length of rod to extend 3 inches beyond sides of window opening.

PART 3 - EXECUTION

3.1 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.

3.2 CURTAIN ROD INSTALLATION

A. Install in accordance with manufacturer’s recommendations.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 123200

KITCHEN CASEWORK

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. Wood-faced kitchen cabinets.
2. Plastic laminate countertops.

1.3 DEFINITIONS

A. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semiexposed Surfaces of Casework: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semiexposed."

C. Concealed Surfaces of Casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.4 SUBMITTALS

A. Product Data: For the following:

1. Cabinets.
2. Laminate materials.
3. Cabinet hardware.

B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.

C. LEED Submittals:

1. Product Data for Credit MR 2.1: Provide certifications for FSC Certified Tropical Wood.
2. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

    a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation to verify source location for both harvesting, manufacturing/fabrication.
    b. Low or No emissions of VOC: Provide materials that comply with VOC limits in reference tables. Provide verification that any composite material used in the products contains no added urea-formaldehyde resins.
    c. Provide required documentation for all the above to verify compliance.

D. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.

1. Plastic laminate for countertop finish, 8 by 10 inches (200 by 250 mm).
2. One unit of each type of exposed hardware.

1.5 QUALITY ASSURANCE

A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes, similar door and drawer configurations, same finish material, and complying with the Specifications may be considered. Refer to Division 1 Section "Substitutions."

C. Quality Standards: Unless otherwise indicated, comply with the following standards:

1. Cabinets: KCMA A161.1.

    a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.

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. Cabinets:

    a. Armstrong.

B. Available Products: Subject to compliance with requirements, cabinets that may be incorporated into the Work include, but are not limited to, the following:

1. Armstrong: Extreme Series, Oak.

    a. Style: Branford.

2.2 COLORS, TEXTURES, AND PATTERNS

A. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range for these characteristics.

2.3 CABINET MATERIALS

A. Exposed Materials: Comply with the following:

1. Exposed Wood Species: As follows. Do not use two adjacent exposed faces that are noticeably dissimilar in color, grain, figure, or natural character markings.

    a. Red oak.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, and kiln dried to 7 percent moisture content.

B. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Plywood: 1/2 inch thick hardwood plywood with exposed edges banded with hardwood edge.

C. Back Panels: 1/4 inch thick hardwood plywood.

2.4 CASEWORK HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, material, size, and finish as selected from manufacturer's standard choices.

B. Hinges: Concealed European-style hinges.

C. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05091.

D. Door and Drawer Pulls:

1. Barrier Free Kitchens: Ives No. 33, brushed chrome finish.
2. All Others: Ives, No. 521, 1-1/4 inch diameter, brushed chrome finish.

2.5 CABINET CONSTRUCTION

A. Face Style: Reveal overlay; door and drawer faces partially cover cabinet body or face frames.

1. Provide built-up base for cabinets where indicated on the drawings.

B. Face Frames: 3/4-inch solid wood.

1. Vertical Stiles: 1-1/2 inch wide.
2. Horizontal Rails: 1-3/4 inch wide.
3. Center Mullions: 3 inch wide.

C. Door and Drawer Fronts: Solid-wood stiles and rails, 1/2 inch thick, with 1/4-inch- thick, veneer-faced plywood center panels.

D. Exposed Cabinet Ends: 1/2-inch- thick hardwood plywood.

E. Cabinet Tops and Bottoms: 1/2-inch- thick hardwood plywood, fully supported by and secured in rabbets in end panels, front frame, and back rail.

F. Back, Top, and Bottom Rails: 3/4-by-3-inch solid wood, interlocking with end panels and rabbeted to receive top and bottom panels. Back rails secured under pressure with glue and with mechanical fasteners.

G. Wall-Hung Unit Back Panels: 1/4-inch thick hardwood plywood fastened to rear edge of end panels and to top and bottom rails.

H. Base Unit Back Panels: 1/4-inch thick hardwood plywood fastened to rear edge of end panels and to top and bottom rails.

I. Front Frame Drawer Rails: 3/4-by-1-1/4-inch solid wood mortised and fastened into face frame.

J. Drawers: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or with glued dovetail joints.
2. Subfronts, Backs, and Sides: 11/16-inch thick solid wood.
3. Bottoms: 1/4 thick plywood.

K. Shelves: 1/2-inch- thick plywood.

L. Joinery: Rabbet backs flush into end panels and secure with concealed mechanical fasteners. Connect tops and bottoms of wall cabinets and bottoms and stretchers of base cabinets to ends and dividers with mechanical fasteners. Rabbet tops, bottoms, and backs into end panels.

M. Factory Finishing: To greatest extent possible, finish casework at factory. Defer only final touchup until after installation.

2.6 COUNTERTOPS

A. Post-formed Countertops: HGP, nominal thickness .038 inch, phenolic resin particleboard with .020" phenolic backer sheet. Provide “D” shaped edge design with 3/8 inch radius edges and 3/16 inch radius coves.

B. Plastic Laminate: Provide by Wilsonart Standard Laminate. Colors as selected by the Architect from manufacturer's full range of available selections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install casework with no variations in flushness of adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.

B. Install casework without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.

C. Install casework and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

E. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Secure backsplashes to tops.
3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
4. Calk space between ends of the countertop and wall with sealant specified in Division 7 Section "Joint Sealants."
5. Calk joints in countertop seams with clear sealant specified in Division 7 Section "Joint Sealants."

3.2 ADJUSTING AND CLEANING

A. Adjust casework and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION

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. This Section includes the following:

1. Carpet-type mats.

1.3 SUBMITTALS

A. Product Data: Include manufacturer's specifications and installation instructions, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of floor mat.

B. LEED Submittals:

1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.

a. Recycled Content: Provide materials that include at least 25% postconsumer or 50% pre-consumer (postindustrial) recycled material.
b. Low or No emissions of VOC: Provide adhesive materials that comply with VOC limits in reference tables.
c. Provide required documentation for all the above to verify compliance.

C.

D. Samples for Selection: For each type of floor mat and frame indicated.

E. Maintenance Data: For cleaning and maintaining floor mats to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: In addition to requirements of authorities having jurisdiction, provide installed floor mats that comply with Section 4.5 in the U.S. Architectural &

Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

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. Carpet-Type Mats:

a. Mats Incorporated.

2.2 FLOOR MATS

A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.

B. Carpet-Type Mats: Polypropylene carpet tile 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. Available Products: Products that may be incorporated into the Work include, but are not limited to, the following:

a. Calypso Tile by Mats, Inc.

2. Tapered Flexible Molding: Tapered vinyl carpet edge moldings with flanges fused to back of mat at all four edges, with mitered corners.

2.3 FABRICATION

A. General: Where possible, verify sizes by field measurement before shop fabrication.

B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

3.2 PROTECTION

A. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

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. This Section includes hydraulic passenger elevators.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
2. Division 04 Section "Unit Masonry" for setting sleeves, inserts, and anchoring devices in masonry and for grouting elevator entrance frames installed in masonry walls.
3. Division 05 Section "Metal Fabrications" for the following:

    a. Attachment plates and angle brackets for supporting guide-rail brackets.
    b. Hoist beams.
    c. Structural-steel shapes for subsills.
    d. Pit ladders.

4. Division 26 Section "Electrical" for telephone service for elevators.
5. Division 26 Section "Electrical" 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.
6. Division 27 Sections for telephone service to elevators.
7. Division 28 Sections 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 apply to work of this Section.

B. Defective Elevator Work: 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.

1.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:

1. Car enclosures and hoistway entrances.
2. Operation, control, and signal systems.

B. Shop Drawings: Show 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 and signals. Include large-scale layout of car control station. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Selection: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- square Samples of sheet materials; and 4-inch lengths of running trim members.

D. 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.

E. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

G. Warranty: Special warranty specified in this Section.

H. Continuing Maintenance Proposal: Service agreement specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Regulatory Requirements: Design elevator system to meet the seismic risk zone as determined by the authority having jurisdiction, including building official and elevator inspector.

C. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

D. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities

having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

E. The elevator installation shall be a design that can be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools, or instructions from the original equipment manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates 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 sequence of elevator installation with other work to avoid delaying the Work.

D. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

E. Coordinate size of elevator pit with manufacturer selected. Provide any necessary revisions to pit or shaft size at no additional cost to the Owner.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service 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 at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, 7-day-per-week emergency callback service.

    a. Response Time: Two hours or less.

B. Continuing Maintenance Proposal: Provide 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.

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. Canton.
2. Otis Elevator Co.
3. ThyssenKrupp Elevator.

2.2 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following:

1. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.
2. Provide motor with solid-state starting.
3. Provide variable-voltage variable-frequency motor control.

C. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.

1. Provide dielectric couplings at cylinder units.
2. Casing for Underground Piping: PVC pipe complying with ASTM D 1785 joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.

E. Hydraulic Fluid: Nontoxic, readily biodegradable made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.

1. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.

F. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.

G. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1, of sufficient size to provide not less than 1-inch clearance from cylinder and extending above pit floor. Provide means to monitor casing effectiveness to comply with ASME A17.1.

H. Corrosion Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler is electrically nonconductive, displaces or absorbs water, and gels or solidifies at temperatures below 60 deg F.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Hydro Safe Oil Division, Inc.; No-Ox-Id Liquid Elevator Casing Filler E-800.
b. Union-Gard, a division of Dome Services L.L.C.; Union-Gard 160.

I. Car Frame and Platform: Welded steel units.

J. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.

2.3 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation system indicated.

B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:

1. 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. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated.

1. Independent Service: Keyswitch in car control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to the door close button.

2.4 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

2.5 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.

2.6 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with nonremovable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
2. Provide finished car including materials and finishes specified below.

B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:

1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch nominal thickness.
2. Floor Finish: Floor finish by others.
3. 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 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range.
4. Fabricate car with recesses and cutouts for signal equipment.
5. Fabricate car door frame integrally with front wall of car.
6. 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.

7. Sight Guards: Provide sight guards on car doors.
8. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
9. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
10. Handrails: Manufacturer's standard handrails, of shape, metal, and finish indicated.

2.7 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Enameled-Steel Frames: Formed from cold-rolled or hot-rolled steel sheet. Provide with factory-applied enamel finish; colors as selected by Architect from manufacturer's full range.
2. 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.
3. Sight Guards: Provide sight guards on doors matching door edges.
4. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
5. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.8 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 incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers.

B. Car Control Stations: Provide manufacturer's standard semirecessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. 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 Division 28 Section "Fire Detection and Alarm."

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.

1. Include travel direction arrows if not provided in car control station.

F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.

1. Provide manufacturer's standard wall-mounted units.
2. Provide units with flat faceplate for mounting with body of unit recessed in wall.
3. Equip units with buttons for calling elevator and for indicating desired 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.

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. Corridor Call Station Pictograph Signs: Provide signs 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.

2.9 ELEVATOR

A. Elevator Description:

1. Type: Under-the-car single cylinder.
2. Rated Load: 2500 lb.
3. Rated Speed: 125 fpm.
4. Number of Stops: 4
5. Vertical Rise: 31’-6”
6. Front Openings: 4
7. Rear Openings: 0
8. Operation System: Single automatic operation.
9. Car Enclosures:

    a. Inside Width: Manufacturer’s standard from side wall to side wall.
    b. Inside Depth: Manufacturer’s standard from back wall to front wall (return panels).
    c. Inside Height: Manufacturer’s standard 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): Enameled steel.
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 and rear of car.
l. Floor: Finish flooring by others.

10. Hoistway Entrances:

a. Width: 42 inches.
b. Height: 84 inches.
c. Type: Single-speed side sliding.
d. Fire-Protection Rating: 1-1/2 hours.
e. Frames: Enameled steel.
f. Doors: Enameled steel.
g. 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 blanket hooks and one complete set of full-height protective blankets.

13. Electrical Requirements:

a. 40 hp.
b. 480V 3-phase.

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. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install cylinder 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 standards for workmanship and for qualifications of welding operators.

C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

D. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.

E. Install piping above the floor, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.

F. Lubricate operating parts of systems as recommended by manufacturers.

G. 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.

H. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.

I. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

J. Locate hall signal equipment for elevators as follows, unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. 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 use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 PROTECTION

A. Temporary Use: Temporary use is not allowed.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s). Refer to Division 01 Section "Demonstration and Training."

B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

C. Check operation of elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 210000

FIRE SPRINKLERS & STANDPIPES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.03 DEFINITIONS

A. Reviewed equal: Shall mean that the Engineer, not the contractor, shall make final determination whether materials are an equal to that which is specified.

B. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer.

C. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.

D. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.

E. 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, crawl spaces, and tunnels.

F. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the General Contractor.

G. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.

H. Piping: Shall mean pipe, fittings, hangers and valves.

I. Provide: Shall mean the furnishing and installing of materials.

J. Substitution: Shall mean materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or cost, than that specified.

1.04 DESCRIPTION OF WORK

A. Work Included

Provide all design services, construction documents, labor, transportation, equipment, permits, materials, tools, inspections, incidentals, tests and perform all operations in connection with the installation of a complete new Hydraulically Designed Wet Pipe Sprinkler System in all areas of the buildings, with Wet Standpipe Systems in the stairwells. Comply with requirements of all Authorities Having Jurisdiction. Include aesthetic considerations into the design. Coordinate with interfacing trades. Submit equipment and components for review. Prepare Shop and Record Drawings and Owner's Manuals. Assure quality of workmanship. Provide guarantees and warranties.

1. Automatic Sprinkler System shall meet the standards of the most recent edition of the National Fire Protection Association's (NFPA) NFPA 13 Standard for the Installation of Sprinkler Systems.

2. A Manual Wet Class 1 Standpipe system shall be provided in the stairwell adjacent to the Knox Box and shall meet the requirements of the National Fire Protection Association's (NFPA) NFPA 14 Standard for the Installation of Standpipe, Private Hydrant and Hose Systems.

1.05 SUBMITTALS

A. Shop Drawings:

1. Within 30 working days after the General Contractor has received a fully executed contract, prepare and submit Plans / Shop Drawings in accordance with the requirements of NFPA and obtain the Engineer's approval and Owner's Insurance Underwriter approval before proceeding with the fabrication and work.

2. Drawings shall include, but not be limited to:
   a. Name of Owner and Occupant
   b. Name and address of Contractor.
   c. Physical Location
   d. Plan view of system
   e. Full height cross section or schematic diagram including ceiling construction and spray obstructions.
   f. Locations of all partitions, with fire partitions noted.
   g. Occupancy class for each area and minimum density of water application.
   h. Locations of concealed spaces
   i. Plan showing location and size of city water main, where private main attaches, all valves, distance and elevation between main and riser.
   j. Recent hydrant test showing both static and residual pressures, and date and time taken. List any significant known daily or seasonal pressure fluctuations and the cause.
   k. Make, model and nominal K factor of sprinkler heads.
   l. Control valves, check valves, drain pipes and test connections.
   m. Fire department connections
   n. Details showing riser piping configurations.

o. Pipe sizes.
p. Switches and supervisory devices.
q. Interface with Fire Control Panel.

3. To obtain an electronic copy of the building plan and sections, contact the Engineer. Specify required CAD format when requesting the files.

4. Procedure

a.. As soon as possible after award of Contract, before any material or equipment is purchased, this Contractor shall submit to the Engineer no less than ten (10) copies for approval. Shop drawings shall be properly identified and shall describe in detail the material and equipment shall be provided, including all dimensional data, performance data, curves, computer selection print-outs, etc.

b. Corrections or comments made on the submittals do not relieve the contractor from compliance with requirements of the specification. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

c. All related items shall be submitted as a package.

4. Submit data on the following items:
a. Piping, fittings and couplings.
b. Alarm check valves and trim.
c. Backflow preventer.
d. Valves and supervisory devices.
e. Sprinkler heads and escutcheon plates.
f. Supports, hangers and accessories.
g. Fire Department Connections.
h. Any other significant item valued over $100.00

5. Submit to the Owner’s Insurance Underwriter sufficient copies for approval to allow one copy to be incorporated into each Owner’s Manual in addition to the required As-Built Plans

1.06 HYDRAULIC DESIGN DATA

A. Building Occupancy:

1. Apartments.

B. Water Density and Square Foot Requirements: Provide per NFPA.

C. Codes and Requirements:

1. Comply with the standards of most recent edition of the National Fire Protection Association.

2. Comply with the BOCA International Building Code, all Maine State laws as well as local codes and ordinances.

3. Comply with the requirements of the State Fire Marshals Office, Local Fire Chief, Owners Insurance Underwriter, Local Water District and other Authorities Having Jurisdiction

1.07 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner.

1.08 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Prepare manuals in durable 3-ring binders approximately 8.1/2" by 11" in size with at least the following:

A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Sprinkler Contractors.

B. Neatly typewritten index.

C. Complete instructions regarding operation and maintenance of all equipment involved.

D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.

E. Copy of all guarantees and warranties issued, and dates of expiration.

F. Shop drawings and equipment/fixtures manufacturer's catalog pages.

PART 2 – PRODUCTS

All products shall be new and must be either Factory Mutual (FM) or Underwriters' Laboratory (U.L.) listed or both.

2.01 MANUFACTURERS

A. Equipment: Grinnell, Standard, Viking, Central Sprinkler Corp., Reliable, or equal.

B. Heads: Viking, or equal.

C. Flow Switch and Supervisory Device: Potter Electric Signal Company or equal.

D. Backflow preventer: Ames or equal.

2.02 MATERIALS

A. Piping:

1. Outside Building, Underground: Is the responsibility of the General Contractor and shall comply with NFPA.

2. Inside building: Shall be schedule 40 black steel, standard weight welded, threaded or Victaulic fittings for sizes 2-1/2" and under. Install flanged fitting and flanges at valves and where required. Threadable light wall pipe (schedule 10) shall be permitted only for sizes 3" and over.

3. Where permitted by code and based on the construction the contractor may substitute CPVC sprinkler system piping in lieu of the above for the sprinkler system. Install according to manufacturer's requirements and restrictions. Piping and fittings, shall be Harvel Blazemaster CPVC fire sprinkler piping or approved equal. Piping shall be installed only by a factory trained and certified installer. Where piping is exposed or where manufacturers requirements cannot be met, piping shall be the same as above.

B. Sprinkler Heads:

1. Temperature Classification:
   a. Finished area shall be ordinary temperature rating.
   b. Boiler Room shall be Intermediate temperature rating 175° F to 225° .

2. All shall be Quick Response type head.

3. All heads shall be glass bulb type .

4. Type:
   a. Generally shall be white, concealed pendant.
   b. Concealed spaces shall be the type best suited for the configuration of the individual space.
   c. Any minor unheated spaces shall be dry type.

5. Provide and install a spare head case per NFPA requirements. The case shall contain not less than 12 heads total, no less than two of each style of heads and one wrench for each style of head. Locate case in the sprinkler room near the check valve assemblies.

C. Provide sprinkler guards on any exposed heads.

D. Hangers: Provide per NFPA. Provide seismic protection unless specifically exempt by the Authority Having Jurisdiction. Hang from building structure, not piping of other trades.

E. Sleeves:

1. Pipes Through Floors: Form with Schedule 40 (galvanized) steel pipe and extend 1" above surrounding floor.

2. Pipes Through Interior Fire-rated or Sound-rated Partitions: Form with steel pipe or 16 gauge galvanized steel.

3. Pipes through Exterior Building Walls, Concrete Walls or Footing: Form with Schedule 40 (galvanized) steel pipe.

4. Size: The minimum sleeve diameter shall be either 2 pipe sizes or 2" in diameter larger than the outside diameter of the pipe.

5. Fire caulk all penetrations through floors and fire rated partitions.

F. Valves:

1. Riser Control Valve: OS&Y cast iron construction.

2. Sectionalizing Valves: OS&Y cast iron body.

3. Drain and Test Valves: Bronze body, gate type or ball type, capable of being padlocked in either open or closed position.

G. Provide all miscellaneous items required for a complete system, such as: paint, signs, valve tags, pipe markers, chains and locks, relief valves, and water additives.

2.03 COMPONENTS

A. Fire Department Connection (Verify with local Fire Department). 4" Fire Department connection with, caps with chains and wall plate with "Auto Sprinkler" and "Manual Wet Standpipe". Thread Pattern shall match that of the local Fire Department equipment; also 4" UL listed check valve with automatic ball drip piped to drain. Bronze finish.

B. Flow Switch for Wet Systems: Model # VSR-F vane type water flow alarm switch with an adjustable retard setting from 10 seconds to 90 seconds having two sets of DPDT contacts for reporting to the building fire alarm system.

C. Electric Supervisory Switch: All valves shall have a Model # OSYSU-2 electric supervisory device with 2 sets of DPDT contacts to report to the building fire alarm system.

D. Backflow preventer: Double check, testable, replaceable seats.

E. Provide all shut-off valves with tamper switches. Lock or chain open valves with break-away padlocks.

F. Water pressure gauge: Provide one before the valve on each inspectors test connection. Range applicable to fire protection application.

PART 3 – EXECUTION

3.01 PREBID EXAMINATION AND INVESTIGATION

A. Visit the site and become acquainted with the conditions.

B. Study all Drawings and Specifications for all related and interfacing trades. No claim will be recognized for extra compensation due to failure to become familiarized with the conditions and extent of the proposed work as indicated within.

C. Ascertain all Authorities Having Jurisdiction, and consult where needed.

3.02 OBTAINING DRAWINGS AND SPECIFICATIONS

A. Obtain a FULL set of drawings and specifications as soon as is practical.

3.03 SPECIFIC INSTALLATION REQUIREMENTS

A. All piping in finished areas shall be run concealed wherever possible.

B. For aesthetic reasons, locate sprinkler heads neatly and symmetrically, relative to the walls, ceiling grid, diffusers and light fixtures. Center heads in tiles in suspended ceilings.

C. All piping shall be run as high as practicable. Pitch piping slightly to allow the system to be drained.

D. System drains shall be valved and piped to discharge. No valve shall be provided ahead of the electric alarm devices.

F. All sprinkler work shall avoid proposed locations of, and installation clearances for, lighting, ducts, piping, framing and equipment.

3.04 COORDINATION

A. Coordinate work with that of other trades. Coordinate early for locations of mains. Ductwork, mechanical equipment, electrical panels and large gravity piping will be given priority over sprinkler piping, unless all effected parties agree otherwise. No compensation will be given for neglect to comply with the above and no claim will be recognized for sprinkler piping, heads and miscellaneous appurtenances which must be modified, removed and reinstalled or relocated, due to conflicts with other work which is or will be installed per the Contract Documents.

B. Contact Electrical Contractor and assure that all requirements for power and fire alarm system have been met.

3.05 TESTS

A. The entire installation shall be tested with water in accordance with all NFPA requirements, all requirements of the local Fire Department and local Water District; and the Owner’s Insurance Underwriter; this includes the testing of all alarms.

B. All tests shall be witnessed by the Owner's representative and local Fire Chief's representative. Submit copies of all test certificates, properly signed, to the Engineer.

END OF SECTION 210000

SECTION 15400

PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings, Addenda, General Provisions of Contract, including General and Supplementary conditions and General Requirements apply to work specified in this Section.

1.02 DEFINITIONS

A. ADA: Designed to meet the requirements of the Americans with Disabilities Act.

B. Adaptable: Designed so in the future it can be easily adapted to meet most of the essential requirements of the Americans with Disabilities Act with minor additions and adjustments, such as change of height of counter or addition of a lift seat.

C. Concealed: Shall mean in walls, in chases, above ceilings, within enclosed cabinets, otherwise enclosed.

D. Equal: Shall mean essentially the same as that product specified, but a model of a different manufacturer

E. Exposed: Shall mean in finished spaces, in closets, under counters, behind and/or under equipment and/or otherwise visible.

F. 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, crawl spaces, and tunnels.

G. Materials: Shall mean any product used in the construction, including but not limited to: fixtures, equipment, piping and supplies.

H. Others: Shall mean provided by sections other than this section. If not purposely assumed by another section, shall be provided by the General Contractor.

I. Piping: Shall mean pipe, fittings, hangers and valves.

J. Provide: Shall mean the furnishing and installing of materials.

K. Reviewed equal: Shall mean that the Architect or a designated Consultant, not the contractor, shall make final determination whether materials are an equal to that which is specified.

L. Substitution: Shall mean materials of significantly different physical, structural or electrical requirements, performance, dimensions, function, maintenance, quality or durability, than that specified.

1.03 ALTERNATES

There are alternates that apply to this section of the project. See PART 4 – ALTERNATES.

1.04 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation, and perform all operations required to install complete plumbing systems in the building, in accordance with these specifications and applicable drawings.

2. Provide the following:

a. Sanitary, waste and vent systems.
b. Domestic hot and cold water system.
c. Storm water systems.
d. Radon mitigation vent system
e. Fuel gas system.
f. Pipe, valve and fittings
g. Water specialties
h. Drainage specialties
i. Circulating pumps
j. Sump pumps
k. Plumbing fixtures and accessories
l. Insulation
m. Installation and/or connections to fixtures/equipment provided by others.

3. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, fixtures and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.

4. Before submitting proposal, This Contractor shall be familiar with all conditions. Failure to do so does not relieve This Contractor of responsibility regarding satisfactory installation of the system.

1.05 PERMITS

A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.

B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.06 CODES AND ORDINANCES

A. All work performed under this Section of the Specifications shall be done in accordance with

applicable Federal Laws, Maine State Laws, Uniform Plumbing Code, Subsurface Wastewater Disposal Rules, and local plumbing codes and ordinances. The following standards are also to be followed when applicable:

ADA	Americans With Disabilities Act
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
BOCA	Building Officials & Code Administrators International, Inc.
NFPA	National Fire Protection Association (a.k.a. NFC, National Fire code)
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act
UL	Underwriter's Laboratories

B. If an obsolete code section or standard is specified, the latest replacement issue of each Code or standard for the application, in effect at the time of bidding, shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.07 QUALITY ASSURANCE

A. Use sufficient qualified workmen and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of the system throughout. Work performed shall conform to manufacturers recommendations, good standard practice and industry standards.

B. Any work deemed unacceptable by the Engineer, Architect or Clerk of the Works shall be redone correctly, at no additional cost to the owner.

1.08 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD drawings will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner unless written permission is obtained.

1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise.

A. Any proposal for substitution of Plumbing equipment shall be made in writing PRIOR TO OPENING OF BIDS. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" shall be intended to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.

B. Approval by Architect for such substitution shall not relieve the Plumbing Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work

C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.

D. Materials and equipment determined as an “approved equal” and /or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. manufacturer, model, etc.) specified.

E. Any additional cost resulting from the substitution of equipment shall be paid by this Contractor.

1.10 PLANS AND SPECIFICATIONS FOR SUPPLIERS

This Contractor shall provide his Suppliers, and any related subcontractors, with a copy of the specification pages, and letter sized photocopies of equipment details and schedules, that pertain to the item to be supplied.

1.11 SHOP DRAWINGS & SUBMITTALS

A. As soon as possible after award of Contract (but not longer than 21 calendar days), <u>before any material or equipment is purchased</u>, Plumbing Contractor shall submit to the Architect no less than ten (10) copies of shop drawings for approval. If shop drawings are not submitted within the allotted time frame all substitutions included the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Plumbing Contractor.

B. Each item shall be properly identified, preferably by fixture/equipment tag number (such as WC-3), and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.

C. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his own expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.

E. Plumbing shop drawings shall be separate from Mechanical shop drawings. All submittals shall have a clear area on the front no less than 4inches x 3inches to be reserved exclusively for the Engineers' shop drawing stamp or they will be refused for re-submittal.

F. It is desirable for shop drawings to be submitted electronically, including all documentation outlined in paragraph “A” above. Hard copies of shop drawings must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.

G. Review must be obtained on all items specified in Section 2 Products or shown on the drawing, and any significant items implied or otherwise required but not specified.

H. Format

1. Related items shall be stapled or Bound together as a package. The number of copies of each package shall be as listed above. Examples of packages of related items include:

    a. Hangers and Supports
    b. Identification
    c. Insulation
    d. Valves
    e. Piping
    f. Plumbing Fixtures with accessories
    g. Drainage Specialties
    h. Water Specialties
    i. Pumps

2. If due to circumstances beyond his control, the contractor is unable to include all the related items in the submitted package, he shall insert in its place a plain sheet of

paper with a notation stating that the item will be submitted separately.

1.12 PRODUCT HANDLING

Use all means necessary to protect materials before, during and after installation, and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.13 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Plumbing Contractor, a record shall be made by the Engineers, and *the cost of the record shall be paid by the Plumbing Contractor*. Copies of the plumbing CAD drawings may be made available electronically to the Contractor if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT". Contact the Architect directly or the Engineer via e-mail at mechsyst@maine.rr.com. Specify required CAD format when requesting the files. CAD drawings were generated using AutoCAD 2006 and utilize both paper space and model space with external references to various other drawings. Files will be compressed and will require "WinZip" (http://www.winzip.com) for extraction. A release form will be provided which must be signed and returned to the Engineer prior to transfer of files.

1.14 MAINTENANCE MANUAL

On completion of this portion of the work, and as a condition of its acceptance, submit for review two copies of a manual describing the system. Plumbing equipment manuals shall be separate from mechanical manuals. All manuals shall be original copies, not photocopies, or they will be refused for resubmittal. Prepare manuals in durable 3-ring binders approximately 8.1/2" by 11" in size with at least the following:

A. Project name on the spine and front cover, and identification on the front cover stating the project name, general nature of the manual, and name, address and telephone number of the General and Plumbing Contractors.

B. Neatly typewritten index.

C. Complete instructions regarding operation and maintenance of all equipment involved.

D. Complete nomenclature of all frequently replaceable parts and supplies, their part numbers, and name, address and telephone number of the vendor.

E. Copy of all guarantees and warranties issued, and dates of expiration.

F. Shop drawings and equipment/fixtures manufacturer's catalog pages. Clearly indicate the precise item included in this installation and delete, cross out or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.

1.15 OBJECTIONABLE NOISE AND VIBRATION

All equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus or piping, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Contractor at no extra cost to the Owner.

1.16 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.17 DEVIATIONS, DISCREPANCIES AND OMISSIONS

A. The drawings are intended to indicate only diagrammatically the intent, extent, general character and approximate locations of plumbing work. Work indicated, but having details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. This shall include but not limited to:

1. All items that are required to meet all applicable codes and referenced standards.

2. Piping for cold and hot water supply, drain, vent, gas, etc to each plumbing fixture/equipment shown on the drawings or scheduled as required.

3. Shut-off valves on lines feeding individual fixtures without integral stops.

4. Minor single phase electrical or control wiring between plumbing provided items that require it, unless indicated on the Division 16 Electrical Drawings.

5. Plumbing related items indicated on the drawings of other trades.

6. Items indicated on one plumbing drawing but not shown on a corresponding drawing.

7. Items implied on the plumbing drawings but not shown.

8. All plumbing related items clearly shown in dark print on the Plumbing drawings but not included in the specification (See paragraph 2.01), unless it is noted as being provided by the owner or other contractor or unless other sections assume the responsibility.

B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the drawings, or in the specifications, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.

1.18 WORKPLACE SAFETY

A. The Trade Contractor alone shall be responsible for the safety, efficiency and adequacy of his plant, appliances and methods, and for any damage, which may result from their failure of their improper construction, maintenance, or operation.

B. All Trade Subcontractors shall notify the General Contractor of any flammable, combustible and/or toxic materials intended for use on the project and shall furnish the General Contractor literature pertinent to the use and control of such materials.

1.19 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

PART 2 - PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, the materials to be furnished under this contract shall be new and the standard products of manufacturers regularly engaged in the production of such equipment, and shall be the manufacturer's latest standard design that complies with the specification requirements.

B. All materials and equipment of the same classification shall be the product of the same manufacturer, unless specified otherwise. An entire product line may be rejected if one or more of the products submitted is not an equal to that specified.

C. All products shall be manufactured within the United States, unless specified otherwise, and supplied locally (within the State) wherever possible. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

D. Unspecified items shall be by the same manufacturer and level of quality and as similar items specified, whenever possible. Whenever items have no similarity to those specified in this section, provide the equivalent item as specified in other Division 15 Sections. When no similarity exists in other sections, the Contractor shall submit for review an appropriate commercial/institutional quality item, complete to perform the functions intended, using his best discretion. The Architect or a designated Consultant, not the contractor, shall make final determination whether materials are of suitable quality and perform the functions intended.

2.03 PAINTING

Painting shall be provided for all steel/iron equipment supports, steel/iron fuel piping, exposed flanges, fittings and valves within boiler rooms, basements and outside and where specified elsewhere within this section. Painting shall consist of no less than two (2) coats of rust inhibiting paint, Rust'O'leum or approved equal. Paint shall be capable of withstanding temperatures of up to 250^{o}F. Colors shall be as follows:

Equipment supports	Flat black
Fuel Gas Piping outside	Prime, then paint with a color to blend into exterior finish.

2.04 HANGERS AND SUPPORTS

A. General

1. All hangers and supports shall be especially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.

2. Piping specified herein shall not be supported from piping of other trades.

3. All steel hangers shall be factory painted.

4. Hangers shall be heavy-duty steel adjustable clevis type, plain for steel, cast iron and plastic pipe, and copper plated for piping in direct contact with copper tubing (i.e. copper hot water piping) shall be equal to Carpenter & Paterson Inc., Fig. 100 (Fig. 100CT copper plated).

5. Hangers shall go outside of insulation where indicated. Each hanger shall be furnished with metal shield; Fig. 100 SH.

6. Exposed vertical risers ¾ inch and smaller shall be supported at 6 foot intervals between floor and ceiling with split ring type hangers; copper plated for piping in direct contact with copper tubing equal to Carpenter & Paterson Inc., Fig.81 (Fig. 81CT copper plated). ALL PIPING DROPS TO FIXTURES SHALL BE ANCHORED SOLID TO WALL WITH A STEEL SUPPORT BRACKET WITH ADJUSTABLE CLIP, ESPECIALLY PIPING TO FLUSH VALVES

7. Piping suspended from walls and partitions shall be supported by steel support bracket with adjustable clips equal to Carpenter & Paterson Inc., Fig. 69. All attachments to bar joists shall be from top chord.

B. Hanger Rods & Attachments

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

Pipe Size	Rod Size
3/8” to 2”	3/8”
2.1/2” to 3.1/2”	1/2"
4” to 5”	5/8”
6”	3/4"

2. All nuts for hanger rods and hangers to be galvanized steel.

3. Provide lag points with rod couplings for fastening to wood, toggle bolts in concrete blocks and compound anchor shields and bolts in poured concrete.

4. Provide toggle bolts with rod couplings for fastening in the pre-cast concrete plank decks.

5. Provide and install angle iron supports for pipe hangers in locations as required. Angle iron supports shall be adequate size for span and piping or equipment.

6. Hot and cold water piping at each fixture shall be securely fastened in wall with split ring type hanger fastened to studs within wall.

2.05 IDENTIFICATION

A. Tag each new pump /equipment, and switch with 2½ inches x ¾ inch rectangular engraved nameplates with white letters on black, #2060-20 by Seton Name Plate Corp. or reviewed equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.

B. Identify all new water and drain piping with “Set Mark” snap-around pipe markers by Seton Name Plate Corporation or reviewed equal. Markers shall include both identification and arrows indicating direction of flow. Markers shall be placed on pipe segments 5 feet and longer, and spaced no less than 10 feet apart. Heating hot water piping shall be labeled differently from Domestic hot water piping. On parallel runs of piping, plumbing markers

shall be grouped together, and grouped with heating markers whenever practical.

Legend	Background/Letter Color
"Cold Water"	Green/ white letters
"Domestic 120°F Water"	Yellow/ black letters
"Domestic 120°F Return"	Yellow/ black letters
"Domestic 140°F Water"	Yellow/ black letters
"Natural Gas"	Yellow/ black letters
"Plumbing Vent"	Green/ white letters
"Sanitary Drain"	Green/ white letters
"Radon Vent"	Green/ white letters
"Roof Drain"	Green/ white letters

C. Tag all new valves with Seton #M4506 1½ inch square brass tags and #6 bead chains, stamped with the following identification: "CW", "HW", "HWR" or "140HW". Tag shall be consecutively numbered. DO NOT DUPLICATE EXISTING VALVE IDENTIFICATION NUMBERS. Fixture stops, control valves or valves adjacent to equipment, the use of which is obvious, are not to be tagged.

D. Provide valve charts identifying valve number, valve identification and service (i.e. Apt. 203, HW). Mount charts in Boiler Room and Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Provide additional copies for maintenance manuals.

2.06 INSULATION

A. Insulation shall be provided for water piping, except exposed connections to fixtures. Insulation systems shall have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less.

B. Cold Water

1. Insulate cold water piping above grade with a minimum one inch (1") thick fiberglass heavy density sectional pipe insulation system with minimum of 7 lb. density and 450° temperature rating having a factory applied vapor barrier laminate all service ASJ jacket. Insulation jacket to have pressure sealing lap adhesive. Provide additional sealing of jacket with flare type stainless steel staples. Staples shall not penetrate more than ½ the insulation thickness. Note: Insulation on branches to each apartment and/or run-outs to individual fixtures may be one half inch (1/2") thick.

2. Shields of 28 gauge metal approximately 8 inches long and forming an arc of approximately 120 degrees to fit insulation shall be provided at each hanger for cold water piping. Shields to be provided by this Contractor. Hangers shall be provided large enough to be outside covering.

C. Hot Water & H.W. Recirculating

Insulate hot water and recirculating piping with minimum one inch (1") thick fiberglass heavy density sectional pipe insulation system and a 450° temperature rating with all service ASJ jacket. Longitudinal jacket flaps to be secured with flare type staples. Note: Insulation

on run-outs to individual fixtures, of ten feet (10') or less, may be one half inch (1/2") thick.

D. Storm Water

1. Insulate all storm water lines above ground with (1") thick fiberglass heavy density sectional pipe insulation as specified for Domestic Water Piping above. Cut insulation to include hangers, then butt insulation tightly together and seal to prevent condensation points.

2. Underside of roof drain boxes:

One inch (1") thickness of a hydraulic setting insulating cement applied in one coat, troweled smooth and finished with 6 oz. canvas pasted over.

- OR -

One inch (1") Armaflex closed cell insulation, neatly and carefully applied (paint with white Armaflex paint where exposed.)

E. Sanitary Waste and Vent Piping Above Parking Area.

1. To deter freezing, insulate all lines with minimum two inch (2") thick fiberglass heavy density sectional pipe insulation and insulation shields as specified for Domestic Cold Water Piping above. Carefully seal to prevent any cold points.

F. Fittings

1. All fittings and valves shall be covered with a one piece PVC insulated fitting cover secured.

2. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished neatly with covering to match jacket and secure with mastic.

3. Valves, flanges and unions on hot water piping shall not be insulated.

G. Installation

All insulation work shall be executed by skilled insulation workmen regularly in the trade.

H. Covering

Contractor shall endeavor to run piping concealed in finished areas whenever possible, however where insulation is exposed in finished areas, it shall be carefully and neatly covered with a white PVC plastic covering material. Covering shall be applied in no less than 4 foot lengths with shingle joints. Longitudinal joints shall be on the top or back sides so as to be out of sight and sealed with adhesive materials provided with the jacketing. Material shall be butted to finish walls or Insulation. Jacketing material shall be Zeston pre-cut, pre-curled 0.030 thickness. Or reviewed equal.

- OR -

Use Owens Corning Evolution SSL II paper free ASJ with tough, wrinkle resistant, easy to-clean jacket. Install will great care for appearance, turning any writing or seams toward the wall. Or reviewed equal.

2.07 VALVES

A. General

1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation; locate to permit easy operation, replacement and repair.

2. All valves must be so constructed that they may be repacked under pressure while open.

4. Check valves shall be installed in all lines where flow may reverse from intended direction.

5. Valves shall have name and/or trademark of manufacturer as well as working pressure stamped or cast on valve body.

6. Valves shall comply with Manufacturer's Standards Society (MSS) specifications and be so listed.

B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

1. Gate Valves 3 inches in size and smaller

Shall have bronze bodies, rising stem, solid wedge, union bonnet, rated for 150# WSP, 300# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1169	1151
Stockham	B-124	B-120
NIBCO	S-134	T-134
Hammond	IB648	IB629

2. Globe Valves 2 inches in size and smaller

Shall have bronze bodies, union bonnet, renewable composition disc for service intended, rated for 150# WSP, 300# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1590-T	590-T
Stockham	B-24-T	B-22-T
NIBCO	S-235-Y	T-235-Y
Hammond	IB423	IB413T

3. Angle valves

Same general description and manufacturers as globe valves above, only outlet at 90 degree angle from inlet.

4. Ball valves 1¼ inches in size and smaller

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350°F:

	Soldered Ends	Screwed Ends
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	------	------
Hammond	8614	8604

5. Ball valves 1½ inches in size and larger

Shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blowout proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "conventional port". Rated for 400# WOG and 350°F:

	Soldered Ends	Screwed Ends
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-585-66	T-585-66
Hammond	8514	8503

6. Check Valves 2 inches in size and smaller

Shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

7. Spring loaded check valves 2" and smaller:

Bronze body, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, Teflon seat unless only bronze available.

	Solder or Screwed Ends
ConBraCo	61 series
Grinnell	3600SJ
Mueller	203BP
Nibco	S480Y
Val-Matic	S1400 series.

8. Drain Valves

Shall be conventional ball valves and provided with hose nipples and threaded metal cap on chain. Watts B-6001-CC or reviewed equal.

9. Balancing Valves

Shall be Globe valve as specified above. Initially set full open.

2.08 DOMESTIC WATER PIPING

A. Water and Fire Service Lines

1. Provide water and fire service lines from where the site work ends. Coordinate interface with site utilities. Match site work materials until inside building.

B. Interior

1. All hot and cold water piping above finish floor (not buried) shall be hard-drawn type "L" copper tube with cast or wrought fittings and made up with Silvabrite 100 lead-free solder.

2. All buried water and trap primer piping shall be type "K" soft copper tubing. No joints below slab. Hot water piping shall be insulated with sealed 1" Armaflex.

3. All exposed, uninsulated water piping in finished areas shall be chromium plated I.P.S. copper or red brass pipe or tubing and fittings. Valves shall also be chrome plated brass or bronze. Any chrome trim with wrench marks shall be removed and new trim installed.

4. Type of tubing shall be stamped or printed on each length by Manufacturer.

2.09 PIPE EXPANSION FITTINGS AND LOOPS

Provide expansion loops on hot water supply (120 degrees and above) and recirculating return lines where shown and on any straight pipe lengths over 100 feet that occur as a result of relocating piping to meet field conditions. Loop shall be 2 feet long by 4 feet offset, and located near center of length. Anchors shall be bolted collars held by angular braces in direction of piping near opposite ends of the pipe. Provide guides on each expansion joint.

2.10 SANITARY WASTE, VENT PIPING AND STORM WATER

A. Sump Pump Piping

All sump pump piping and all waste piping 1.1/4" size and smaller, not buried, shall be type "L" hard drawn copper tubing with drainage fittings made up with 95-5 solder. All exposed piping or tubing in finished areas shall be chrome plated copper or brass. All chrome trim with wrench marks shall be removed and new trim installed.

B. Vent Piping, and Underslab Sanitary and Storm Water Piping

All piping and fittings shall be PVC Schedule 40 polyvinyl chloride plastic, as per ASTM-A-2665 or latest standard. Solvent as per ASTM-D-2564. Exposed vent piping above roof shall be **black** PVC or CPVC for appearance and solar heat dissipation of frost.

C. Sanitary Waste and Storm Water, Above Slab

For sound attenuation, all sanitary waste pipe and fittings, above the slab, shall be standard weight cast-iron, conforming to Commercial Standards CS188-66. Fittings shall be cast-iron, no-hub ASA Group 022 pipe, complete with neoprene elastomer, corrosion-resistant stainless steel shield and clamping assemblies conforming strictly to ASME Standard C654 and requirements of CISPI Standard 310.

Substitution with PVC piping, or other piping system with inferior sound deadening characteristics, is not allowed. Substitution of piping system with equal or superior sound deadening characteristics can be submitted for review provided it is accompanied by:

1. Manufacturer's literature citing proof of acoustic properties by an independent laboratory testing agency.

2. Shop drawings showing how the new piping assembly, with any sound insulation required, can be fitted into the designated wall or space. Note: any preparation of sketches or engineering time required by a consultant for this, shall be reimbursed by this contractor.

3. Shop drawings showing the fire stopping system used and/or how the piping transitions through fire rated walls.

4. A proposal for sizeable credit. Note: proposal must also detail the cost of any related changes required by other trades, such as adding insulation or fattening of walls, to accommodate the proposed change. Any related charges that arise after the change order is approved, shall be paid by this contractor, at no additional cost to the owner.

2.11 RADON VENT PIPING

A. Radon vent piping and fittings shall be PVC Schedule 40 polyvinyl chloride plastic, as per ASTM-A-2665 or latest standard. Solvent as per ASTM-D-2564. 4" underslab piping shall be perforated type wrapped with woven geotextile fabric. Exposed vent piping above roof shall be **black** PVC or CPVC for appearance and solar heat dissipation of frost. Gooseneck the termination and provide insect screen.

2.12. FUEL GAS PIPING

A. Coordinate with General Contractor and contact the Gas Supplier and for installation of gas meter/entrance. Provide a second regulator after the entrance if the one supplied by the Gas Company is not adjustable within the range required of the gas using equipment.

B. Piping after the entrance shall be Schedule 40 black steel pipe, ASTM 120 with 150# fittings.

a. Piping 2" and less in diameter shall be screwed pattern malleable iron fittings, shall meet ASTM A-47, ASA B16.3. Pipe joint compound shall be used on all threaded joints.

b. Piping shall use welded fittings if over 2" in diameter, or if pressure in excess of 14" W.C.

C. Provide dirt leg, gas cock and union at each boiler. Provide gas cock and flex connect with union at each clothes dryer.

D. Installation shall meet the requirements of the gas supplier and NFPA 54.

2.13 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than pipe. Piping passing through walls other than masonry shall be provided with # 24 gauge galvanized steel tubes with wired or hemmed edges.

2. Sleeves set in concrete floors shall finish flush with underside, but extend minimum of 1 inch above finish floor. Weld clips to sleeves for support in concrete pre-cast planks of a size that will be covered by concrete topping. Sleeves set in partitions shall finish flush with each side.

3. Space between sleeves and pipes shall be sealed to make smoke and water tight with 3M Brand Fire Barrier Caulk CP25 or Putty 303.

4. Masonry sleeves shall be Schedule 40 steel pipe.

5. This Contractor has the option to use the Pro-set system on lieu of the above.

B. Exterior Sleeves

Where piping passes through exterior walls, provide and install a complete pipe sleeve/hydrostatic wall closure system.

1. Wall sleeve shall be schedule 40 steel pipe, two pipe sizes larger than carrier pipe. Sleeve shall be the same length as the thickness of the wall served.

2. The hydrostatic closure device shall consist of identical interlocking links of solid synthetic rubber compounded to resist ozone, water, chemicals and extreme temperature variations. Each link shall be connected by corrosion resistant bolts and nuts to form a belt that is to fit snugly around the pipe. Under each bolt and nut there shall be a metal pressure plate so that when each nut is tightened the rubber links will expand between the pipe and sleeve to form a continuous, air tight and water tight seal.

3. Units to be Link-Seal system Model LS wall seal by Thunderline Corp. or reviewed equal.

C. Escutcheons
Where piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates.

2.14 PLUMBING FIXTURES

A. CW-1 Clothes Washer

1. Appliance is not provided by this contractor. Coordinate with G.C.

2. Guy Gray WB-200 recessed supply and drain unit for automatic washers, ½" Watts Duo-cloz valve, 2" drain, white enameled steel. Or approved equal.

3. Provide two (2) PPP Laundry Mini water hammer arresters. Or approved equal.

4. Provide two (2) Braided Stainless Washing Machine Hoses one side has 90 degree elbow, NSF 61 listed, UPC rated 3/4" FHT x 3/4" 90 degree FHT 5ft (60") hose.

5. Provide Dura-Pan 30"x32" molded fiberglass washer pan with center outlet and removable stainless steel front. Or approved equal.

B. DW-1 Dishwasher, Under Counter

1. Appliance is not provided by this contractor. Coordinate with G.C.

2. Provide PPP Mini water hammer arrester. Or approved equal.

C. LV-1 Lavatory, Countertop

1. AMERICAN STANDARD 476.028 Aqualyn Countertop Lavatory, oval, vitreous china, self rimming, front overflow, faucet ledge, holes on 4" centers, color "white". Or reviewed equal. Counter by G.C.

2. Moen model 8414, commercial brass, single handle lavatory faucet, 4" centers, ceramic control components, pop-up drain assembly, chrome, meets ADA. Provide 1.5 gpm aerator Or reviewed equal.

3. McGuire chrome P-trap, chrome plated angle supplies, wheel stops, wrought (not bell) escutcheons. Or reviewed equal.

4. Installation note: as the sink cabinet might be designed to have the front removable and the counter height adjustable, care must be taken not to install any piping in such a manner that would cause an obstruction to this or to full wheelchair access.

D. LV-2 Lavatory, Countertop – ADA

1. Same as LV-1 except counter is open and fixed at 34".

2. McGuire Prowrap insulated P-trap and supply covers, chrome plated angle supplies, wheel stops, wrought (not bell) escutcheons. Or reviewed equal.

E. MB-1 Mop Basin

1. The mop basin shall be Fiat MSB-2424, molded stone or reviewed equal. The molding shall be done in matched metal dies under heat and pressure resulting in a one-piece homogeneous product. Size of unit shall be 24"x24"x10" high.

The drain body shall be cast brass, chrome plated, complete with cast brass lock nut and gaskets. A combination dome strainer and lint basket made from #302, 16 gauge stainless steel attached with tamper proof screws shall be included. The drain body shall provide for a lead caulked joint to be 3" I.P.S.

Provide the following accessories:
a. Stainless steel wall guard, MSG-2424
b. Service faucet with vacuum breaker; integral stops and wall brace plate #830-AA, or reviewed equal.
c. 30" Hose with ¾" coupling at one end; Plate #832-AA.
d. Mop Hanger, stainless steel, 24" long with (3) holders, Plate #889-CC.
e. Silicone sealant #833-AA.
f. Vinyl bumper guard #-77-AA.

F. SK-1 Sink, Double Bowl

1. Elkay LR-3322-4 double bowl stainless steel sink, two 13-1/2" x 16" x 8" bowls, 18 gauge, type 302 SS, self-rim, satin finish, sound guard undercoating, 4 hole drilling . Or reviewed equal.

2. Moen model 8722 brass commercial single lever handle kitchen faucet with hose and spray, deck plate, 8" centers, washerless cartridge, aerator, 12" spout, chrome, meets ADA, or reviewed equal.

3. McGuire chrome 1-1/2" P-trap, continuous waste and supply covers, chrome plated angle supplies, wheel stops, wrought escutcheons. Or reviewed equal.

G. SK-2 Sink, Double Bowl – ADA

1. Elkay LRAD-3322-65-4 double bowl stainless steel sink, two 13-1/2" x 16" x 6-1/2" bowls, 18 gauge, type 302 SS, self-rim, satin finish, sound guard undercoating, 4 hole drilling . Or reviewed equal.

2. Moen model 8722 brass commercial single lever handle kitchen faucet with hose and spray, deck plate, 8" centers, washerless cartridge, aerator, 12" spout, chrome, meets ADA, or reviewed equal.

3. McGuire Prowrap insulated 1-1/2" P-trap, continuous waste and supply covers,

chrome plated angle supplies, wheel stops, wrought escutcheons. Or reviewed equal.

H. TS-1 Tub / Shower – Right Hand

1. Enclosure shall be Lasco model 260330M, gel-coated fiberglass, right hand valve, open top, 17" max height tub at finished floor, outside dimensions 60" x 31-1/4" x 75-1/4", textured floor, color white. Accessories: Reinforce shower walls for future grab bars, heavy duty shower curtain, curtain rod. Or reviewed equal.

2. Controls shall be Moen model 8389 metal commercial tub shower system with tub spout and fixed head shower system mixing valve – Posi-temp pressure balanced valve with trim, single handle, integral stops, chrome. Install with fixed head centered at 84". Substitute model 6306 1.7 GPM for shower head. Or reviewed equal.

3. McGuire 1221TL22, height 12 to 14", chrome plated brass commercial bath waste and overflow, trip lever, flat strainer, 17 gauge tubing. McGuire P-trap

I. TS-2 Tub / Shower – Left Hand

1. Same as TS-2 except mirrored.

J. TS-3 Tub / Shower – Right Hand – ADA

1. Enclosure shall be Lasco Freedomline model 2603SMTH, gel-coated fiberglass, right hand valve, open top, 17" max height tub at finished floor, outside dimensions 60" x 33-1/4" x 77", textured floor, color white. Accessories: Factory mounted 1-1/2" white grab bars, tri-fold plastic removable seat (on left hand side), heavy duty shower curtain, curtain rod. Or reviewed equal.

2. Controls shall be Moen model 8343 metal commercial tub shower system with tub spout fixed and hand shower system with 3 function diverter and mixing valve – Posi-temp pressure balanced valve with trim, single handle, integral stops, single function hand shower with slide bar, chrome, 69" flexible hose assembly, integral vacuum breaker. Substitute model 6306 1.7 GPM fixed shower head and 8349LF16 1.6 GPM for hand held shower head. Install slide bar with A750 secure mount anchor. Or reviewed equal. Note: If providing an equal shower head flow to be 1.7 GPM or less. Install with fixed head centered at 84". Install slide bar on inside corner side to be out of the way. Or reviewed equal.

3. McGuire 1221TL22, height 12 to 14", chrome plated brass commercial bath waste and overflow, trip lever, flat strainer, 17 gauge tubing. McGuire P-trap

K. TS-4 Tub / Shower – Left Hand – ADA

1. Same as TS-3 except mirrored.

L. WC-1 Water Closet, Floor

1. AMERICAN STANDARD 2479.516 FloWise Dual Flush, 14-3/4, Elongated Toilet, vitreous china, 0.8/1.6 GPF, Aquaguard liner tank, bolt caps, fully glazed trapway, matching plastic seat with cover, color “white”. Or Reviewed equal, if any.

2. McGuire chrome water closet supply with wheel handle stop. Or reviewed equal.

3. To minimize invert drop for water closets with cast-iron piping, use a push-on closet flange with a plain end closet bend. Tyler Pipe or reviewed equal.

M. WC-2 Water Closet, Floor – ADA

1. AMERICAN STANDARD 2480.516 FloWise Dual Flush Right height 17-3/4, Elongated Toilet, vitreous china, 0.8/1.6 GPF, Aquaguard liner tank, bolt caps, fully glazed trapway, matching plastic seat with cover, color “white”. Or Reviewed equal, if any.

2. McGuire chrome water closet supply with wheel handle stop. Or reviewed equal.

3. To minimize invert drop for water closets with cast-iron piping, use a push-on closet flange with a plain end closet bend. Tyler Pipe or reviewed equal.

N. WC-3 Water Closet, Floor – ADA

Same as WC-2 except if providing an equal and the tank has a side trip lever, then order with alternate tank configuration with trip lever located on right side.

2.15 EQUIPMENT OR PLUMBING FIXTURES BY OTHERS

Any equipment and fixtures by other sections will be provided and set in place by those sections. This contractor will connect gas, domestic hot water, waste and vent as required.

A. Hot water storage tank

1. Tank is provided and set in place by Section 15600. Provide and connect all domestic water piping, fittings, valves, and pumps as shown on drawings.

2. Water temperature in storage tank shall be 140^{o} F. Water temperature to most fixtures shall be 120^{o} F. set by thermostatic mixing valve at tank.

B. Boiler

1. By Section 15600. Provide gas connection and water make-up as required.

2.16 PLUMBING SPECIALTIES, DRAINAGE

A. Carriers

1. Wall hung fixtures including water closets, lavatories, lav-decks and drinking fountains shall be supported with adjustable floor mounted carriers to fit building conditions, piping system, and fixtures specified. Each carrier shall be provided

with a wall finishing frame. All carriers shall be secured to the floor with tie down lugs.

2. Carriers shall be as manufactured by Zurn or reviewed equal.

B. Traps

1. Traps of material and design as approved by the State and shall be furnished and installed at all fixtures and appliances. Trap each fixture separately, keeping all trap screws below water line; vent each trap. Make offsets in vent piping with 45-degree angle fittings when possible. Pitch horizontal vents toward waste lines, group vents and take through roof as shown. All traps, at fixtures and appliances shall be provided with accessible clean outs.

2. All exposed traps, piping and fittings under sinks and lavatories shall be chrome-plated.

C. Cleanouts

Provide cleanouts for soil and waste where shown on the drawings and as required by code.

1. Floor Cleanouts (FCO)

All floor cleanouts in concrete or tile shall be flush with finish floor.

a. Type “1”, Round, recessed for 1/8” tile

Zurn ZN-1400-BP-X-K, thin nickel bronze rim, bronze plug, anchor flange. Thick rimmed tops such as made by Watts are NOT acceptable.

NOTE: Coordinate tile insert with tile installer at time of floor installation. Adjust height of rim to the thickness of the tile to be used so that it will be flush with the finished floor and oriented correctly before the tile installer arrives. Failure to prepare or coordinate properly will result in this contractor paying for the call-back of the tile installer at no additional expense to the Owner.

b. Type “2”, Round, for unfinished areas

Zurn Z-1400-BP-K, cast iron top, bronze plug, anchor flange.

c. Type “3”, Round, for Carpet with marker

Zurn ZN-1400-CM-BP-K, carpet marker, nickel bronze, bronze plug, anchor flange.

2. Wall Cleanouts

All wall cleanouts shall be Zurn Z-1445 cleanout tee with threaded plug. Polished nickel bronze cover, Zurn ZANB-1462 or reviewed equal.

3. Flashing

Flash each above grade floor clean out with Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, extending 24" beyond perimeter of clean out and lock into clamping collar.

D. Floor Drains (FD)

1. All floor drains above grade shall be complete and each provided with flashing flange, flange device, and 24"x24", Chloraloy® 240 thermoplastic elastomeric sheet membrane for concealed waterproofing, or other approved flashing material, lock into drain clamping collar.

2. Traps for floor drains shall be deep seal traps. Those without trap seal primers shall be topped-off with 12 oz. of mineral oil to retard evaporation. Those in poorly heated areas, such as loading docks and penthouses, shall be filled with an undiluted non-toxic, non-corrosive antifreeze effective to at lease -20 deg F.

a. Type "1" General. Round

Cast iron body, flashing collar, nickel bronze, 6" adjustable strainer head, inside caulk, trap primer connection. Zurn ZN-415-6B-P or equal by Josam, Wade or Smith.

If not protected by a trap seal primer ,provide Sure Seal mechanical odor stopper as manufactured by Sure Seal Manufacturing, Tacoma, WA - (877)201-2663, IAPMO Listed #4165.

b. Type "2" Indirect Waste w/ recessed grate

Cast iron body, flashing collar, polished bronze, 7" adjustable raised flanged grate, inside caulk, trap primer connection. Zurn ZB-415-7I-P or equal by Josam, Wade or Smith. Install with top of flange flush with floor so grate is recessed, or approved equal

If not protected by a trap seal primer ,provide Sure Seal mechanical odor stopper as manufactured by Sure Seal Manufacturing, Tacoma, WA - (877)201-2663, IAPMO Listed #4165.

c. Type "3" Boiler Room

Cast iron body, flashing collar, sediment bucket, polished bronze, 7" adjustable deep flanged grate, inside caulk, trap primer connection. Zurn ZB-415-7N-P-Y or approved equal.

If not protected by a trap seal primer ,provide Sure Seal mechanical odor stopper as manufactured by Sure Seal Manufacturing, Tacoma, WA - (877)201-2663, IAPMO Listed #4165.

E. Roof Drain (RD)

1. Roof drains will be provided by This Contractor and set in place by the Roofing Contractor. This Contractor to connect to drains.

a. Type “1” Main Roof Drain

Zurn Model Z-100-E-R-C, 15” cast iron body, polydome.

b. Type “2” Canopy Drain Standpipe (Alt #2)

Provide a standpipe to receive a gutter downspout.

2. Provide a wall cleanout at the base of all rain leaders as specified under wall cleanouts.

2.17 PLUMBING SPECIALTIES, WATER

A. Trap Primer (TP)

1. Type “1” General

Precision Plumbing Products Inc. Model PR-500 Self-adjusting automatic trap primer. Provide DU-2 distribution unit where indicated. Or reviewed equal. NOTE: As the trap primer may be on a line larger than 1/2”, submitting / providing a “flow through” type trap primers smaller than the actual pipe size is not acceptable.

B. Hose Bibs (HB)

1. Type “1” Exterior Hose Bib

Zurn Z-1321 exposed Ecolotrol “Anti-Siphon” automatic draining, non-freeze wall hydrant, integral backflow preventer, all bronze interior parts, operating key. Or reviewed equal.

C. Shock Absorbers (SA)

Shock protection shall be provided where shown on drawings and at all quick closing devices. Devices shall be stainless steel shell, welded expansion bellows surrounded by on-toxic mineral oil or gas, pressurized compression chamber charged and factory sealed, all, in-line design, threaded nipple and PDI reviewed. Sized to meet the conditions.

1. Type “1”, 'A' P.D.I. units

Zurn Z-1700, #100. Or reviewed equal.

2. Type “2”, 'B' P.D.I. units

Zurn Z-1700, #200. Or reviewed equal.

D. Thermometer (T)

Units to be dial type, 4.1/2" with 30° to 180° range; Trerice Universal angle or reviewed equal.

E. Pressure Gauge (P.G.)

Furnish and install pressure gauges with gauge cocks on piping where shown on drawings. The dial range shall be such that the normal pressure shall be approximately mid-way of dial. Gauges shall be Trerice No. 600 or equivalent by Weiss or Nurnburg, 4.1/2" dial size, cast aluminum case, with brass "T" handle cocks and No. 872 bronze pressure snubbers on water units.

F. Vacuum Relief Valve

Watts Model N36 or reviewed equal.

G. Backflow Preventers (BFP)

Provide and install all necessary components to provide protection against potentially hazardous backflow or back siphonage and the contamination of the potable water system at the required GPM demand. Unit shall be UL, USC, ASSE, 1APMD and AWWA approved.

1. Type "1", Entrance

Watts 007M2QT-S double check backflow preventer, 1-1/2" or 2", quarter turn full port ball valves, strainer, 6 psi fall-off at 75 GPM. Or reviewed equal.

2. Type "2" Mechanical Equipment

Watts #9DM2 double check with atmospheric port, or reviewed equal.

H. Mixing Valves (MV)

1. Type "1" Master Mixer

Symmons thermostatic mixing valve Model 5-500, inlet size 1", outlet size 1.1/4" capacity 38 GPM @ 10 psi differential pressure for exposed piping, solid bi-metal thermostat scale hot to cold, rough bronze, check stops, set at 120°F. Or reviewed equal.

I. Expansion Tank

Watts Model DETA-30. Potable water expansion tank, 15 gallon, 10.5 gallon acceptance, 1" connection, precharged to 40 psi. Or reviewed equal.

J. Relief Valve

Watts #530 calibrated pressure relief valve. Set at 100 PSI. Or reviewed equal.

K. Braided Stainless Steel Water Connectors

EPDM tubing jacketed by type 304 stainless steel braid, stainless ferrule, brass nuts. By Zurn or reviewed equal.

L. Dielectric Unions

Series 3000 as manufactured by Watts or reviewed equal.

M. Meter

Provide a meter that meets the criteria of the local water district and has remote reader.

2.18 SUMP PUMP (SP)

Type 1, Elevator Pit

Stancor model SE-40 sump pump with oil minder probe and alarm, 4/10 hp 115 V, 1 phase, 8 amps, or reviewed equal.

2.19 DOMESTIC HOT WATER CIRCULATOR PUMPS (DCP)

A. Circulators

Provide and install in-line all bronze, corrosion proof, circulating pump on hot water circulating lines with capacity as shown on the drawings. Unit to be provided with internal overload protection.

1. Type 1 – 120 deg System

Circulator to be Taco Mode 008, bronze construction, ¾" union ends, 7 GPM at 10 ft. head, 1/25 HP, 115V/60/1 or reviewed equal.

B. Control – Manual shut-off switch; pump to run continuously.

C. All power wiring and manual power switch with indicator light shall be provided and installed by Division 16.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations and the reviewed Shop Drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

3.02 COORDINATION WITH OTHER TRADES

A. Before installation, participate in a coordination meeting with the Clerk of the Works, General Contactor, Mechanical/HVAC, Fire Protection and Electrical trades. Establish and resolve areas of conflict and congestion, especially those indicated on the drawings. Priority to be given to HVAC equipment and large ductwork, then gravity piping, then small ductwork, then piping based on descending order of size. Special consideration given to allow access to valves, dampers etc. Mutually develop coordination sketches documenting space allocation and provide copies to all effected trades.

B. Failure to coordinate will result in this contractor removing and relocating his piping at no additional expense to the owner.

3.03 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. Install all piping promptly, making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.

2. Provide uniform pitch of at least ¼ inch per foot for all horizontal waste and soil piping 3” or less. For piping 4” and above, slope at 1/8” minimum per foot

3. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective material from the jobs site.

4. Install pipes to clear all beams and obstructions. Do not cut into or reduce the size of load carrying members without the approval of the Architect.

5. Plumbing and Radon vents

a. Back vent all plumbing fixtures.
b. Pitch all vents at 1/32” per foot minimum toward waste lines for proper

drainage to prevent unintended traps.

c. Install vent piping with each bend 45 degrees minimum from the horizontal, wherever structural conditions will permit.

d. Group plumbing vents and take through roof as shown.

e. Increase vents 3" and smaller one size before going thru roof. Make size transition a minimum of 12" below the surface of flat roofs and 72" (or as structure permits) below sloped roofs.

f. Terminate 18" to 24" above roof.

g. If installing in locations other than as shown on the drawings, line up with other plumbing vents for a neat appearance.

h. Do not install plumbing vents within 10 feet of an operable window or door or within 25 feet of a ventilation air intake.

6. All risers and off-sets shall be substantially supported.

7. Pipe hangers shall be placed on center as follows:

MATERIAL	HORIZONTAL	VERTICAL
Cast-iron	At joints not to exceed 10'	15' or at each story whichever is less, and stacks at the base
Copper 1-1/4" & less	6'	6'
1-1/2"	6'	10'
2" & up	10'	10'
PVC, DWV	4'	4'
Steel	10'	10'

8. Arrange all piping to maintain required grade and pitch to lines to prevent vibration. Expansion loops to anchors shall be provided where shown on drawings.

9. Make all changes in pipe size with reducing fittings.

10. All low points in water piping shall be drained with ½" gate valve with hose nipple and metal cap.

11. No piping shall be installed in such a manner to permit back-siphonage or flow of any liquid in water piping under any conditions.

12. No water piping shall be installed outside of building or in an exterior wall unless adequate provisions are made to protect such pipe from freezing.

13. All piping and drain openings left unattended will be capped, plugged or securely covered to prevent accidental entry of foreign matter. Roof drains in use will be provided with domes.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside the fittings; use graphite on all clean out plugs. DO NOT use Teflon tape on gas piping.

2. Smoothly ream all cut P.V.C. pipe. Clean and use solvent for fitting connection and

in strict accordance with the manufacturer's recommendations.

3. Make all joints in copper water tube with solder applied in strict accordance with the manufacturer's recommendations.

C. Coordinate with the General Contractor to depress the finished floor where indicated on drawings. Install floor drains at low points of surface areas to be drained. Adjust grates of drains 1/32" below finished floor, unless otherwise indicated. Finished floor shall be depressed according to the following drainage area radii:

1. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

2. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.

3. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3.04 STERILIZATION AND FLUSHING OF PIPES

A. After preliminary purging of the system, chlorinate the new potable water system in accordance with the current recommendations of the American Water Works Association, and in accordance with all pertinent codes and regulations. Chlorinate only when the building is unoccupied.

B. Upon completion of the sterilization, thoroughly flush the entire potable water system.

C. After sterilization and flushing are complete, a sample shall be collected from the end of the longest main, or at any other location selected by the Architect, and a water analysis test provided. The test must prove the water acceptable or additional disinfecting of system performed. A copy of the test report shall be submitted to the Architect.

3.05 CLOSING IN UNINSPECTED WORK

A. Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect and at no additional cost to the Owner.

3.06 TESTING OF PIPING

Tests shall be applied to the plumbing installation as required by codes and where as directed by the Architect, and in all cases before work is covered by earth fill or pipe covering.

A. Sanitary piping shall be tested when all underground work is complete (before covering) and again, after all piping is installed, but before it is further closed in. Sanitary systems shall be securely stopped, except at the highest point, and the entire system filled with water to the point of overflow for 24 hours. All leaks shall be repaired. Cracked pipes and fitting shall

be removed and replaced. No doping of soil pipe or fittings will be allowed. Plan testing around expected weather and temperature conditions or provide protection so that pipes do not freeze.

B. New domestic water piping shall be filled and subjected to a hydrostatic pressure test of 150 psi for 8 hours with no leaks. If leaks are detected they shall be repaired and the test repeated until work is tight. NOTE: Testing with compressed air only is NOT ACCEPTABLE.

C. Testing of Fuel Gas piping shall conform to NFPA 54. Testing of natural gas piping shall also conform to the requirements of the gas supplier.

3.07 CLEANING

A. Prior to acceptance of the buildings, thoroughly clean all exposed portions of the this installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item, being careful to avoid all damage to finished surfaces. Additional attention may be required to thoroughly clean any used, re-used or owner provided fixtures.

B. Clean out all strainers and aerators and adjust or replace washers, cartridges, etc

3.08 INSTRUCTIONS

On completion of the job, this Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The time of instruction shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials, both new and removed, shall be recycled whenever practical through metal salvage dealers (piping, etc.), paper salvage (cardboard shipping containers, etc.), wood products, etc. The Plumbing Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury or any other material deemed by the Federal Environmental Protection Agency or the State Department of Environmental Protection to be hazardous shall not be used in any components of the plumbing systems.

PART 4 - ALTERNATES

4.01 GENERAL

A. All provisions of Part 1, “GENERAL” and Part 3, “EXECUTION” also apply to these alternates.

4.02 ALT #2 – Canopy Drains

Add alternate to provide canopy downspout standpipes and piping where indicated.

END OF SECTION 220000

SECTION 230000

MECHANICAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

1.02 ALTERNATES

There are alternates that apply to this section of the project.

1.03 INTENT

It is the intent of the drawings and specifications to provide for the installation of heating and ventilating systems which are safe, quiet, and economical in operation and complete in all respects. The heating system will provide a uniform temperature of 70 degrees F. in all living spaces as may be noted on the drawings, when the outside temperature is -2 degrees F. All materials and equipment necessary to accomplish the intent shall be furnished and installed by the heating (mechanical) contractor.

1.04 DEFINITIONS

ATC Automatic Temperature Control
EC Electrical Contractor (Division 16)
GC General Contractor
HC Heating (mechanical) Contractor
PC Plumbing Contractor

1.05 DESCRIPTION OF WORK

A. Work Included

1. Furnish all labor, materials, equipment, transportation and perform all operations required to install complete heating and ventilating systems in the buildings, in accordance with these specifications and applicable drawings.

2. All temperatures are expressed in degrees Fahrenheit.

3. Work to be performed shall include, but is not limited to, the following:

a. Provide and install forced hot water heating system in building areas indicated on drawings.
b. Provide and install exhaust systems in building areas indicated on drawings.
c. Pipe, valve and fittings
d. Hot water specialties
e. Circulating pumps and boiler work
f. Radiation

g. Cabinet unit heaters
h. Insulation
i. Fans
j. Sheetmetal
k. Temperature control
l. Tests and balance

4. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, ductwork and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.

5. Before submitting proposal, Mechanical Contractor shall be familiar with all conditions. Failure to do so does not relieve Mechanical Contractor of responsibility regarding satisfactory installation of the system.

6. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors') materials and equipment into place.

7. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under this section.

B. Related Work Described Elsewhere

1. Excavation and backfill
2. Cutting and patching
3. Firestopping between building construction and pipe sleeves and between building construction and ductwork, Section 07900.
4. Electrical conduit and wiring, except as noted below
5. Roofing, curbs, curb openings and framing of openings.
6. Setting of sleeves in masonry work (sleeves provided by Mechanical Contractor)
7. Door louvers
8. Finish painting, Section 09900
9. All finish work

C. Commissioning

1. A commissioning agent has been retained by and works directly for the Owner. The commissioning agent's responsibility shall include ensuring the mechanical systems function as designed. A full scope of the agent's duties may be provided on request.
2. This contractor shall provide documentation on mechanical equipment that may be requested by the commissioning agent with notification provided to the Architect of such.
3. Should the commissioning agent requested changes or alterations to the mechanical systems, said changes or alterations must be authorized by the Architect or Engineer of record prior to work. See part 1.19, "CHANGE ORDERS".
4. The scope of the mechanical contractor's responsibility regarding commissioning shall include (but not be limited) to:

a. Attend commissioning meetings.

b. Coordinate factory start up of the ATC and boiler systems to include the commissioning agent. Coordination shall include as a minimum 5 working days notice of factory start up tests.
c. Coordinate and provide at least 5 working days notice of testing and balancing contractor being on site to allow the commissioning agent to observe the process.
d. Complete check lists on boilers, pumps and controls.
e. Demonstrate all sequences of operation of all mechanical equipment.

D. Mechanical Electrical Work

1. Provide and erect all motors, temperature controls, limit switches as specified.

2. Power supply to switches, fused switches, outlets, motor starters, to line terminals of equipment, and all related wiring and fuses to properly connect and operate all electrical equipment specified shall be furnished and installed under Division 16, "ELECTRICAL" (Division 16). Division 16 shall not mount electrical equipment to indoor mechanical equipment without the consent of Division 15. Division 16 shall not drill wiring holes in equipment casings but shall make use of factory wiring knockouts when present. Coordinate all wiring between Mechanical and Electrical to provide a complete and operating system.

3. All power wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric code, National Fuel Gas Code, and Local Codes Division 16. Install all wiring under the supervision of the Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.

4. Automatic Temperature Control (ATC) Systems

Electric wiring for ATC systems shall be furnished and installed by ATC Contractor under supervision of Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section. Low voltage wiring shall be plenum rated and installed in an organized manner. Conduit for low voltage wiring shall not be required.

5. Boilers

Division 16 shall provide a separate circuit breaker for each boiler and wire to line terminals on unit control.

6. Fans

a. Division 16 to wire to unit mounted disconnect switches with overload protection provided with units.
b. Division 16 to provide 120 volt power from exhaust fans to motor operated dampers associated with each fan, where provided. Dampers and actuators to be provided by ATC Contractor.

7. Automatic Temperature Control (ATC) Panel

Division 16 shall provide a dedicated 120 volt, 15 amp circuit breaker for each temperature control panel. Wiring from circuit breaker to temperature control panels will be provided and installed by the ATC Contractor. Division 16 shall also provide a duplex convenience receptacle on a separate circuit within 6 feet of panel.

8. Circulating Pumps

Division 16 shall provide and wire a disconnect switch for each pump. Division 16 shall provide and wire magnetic starters for three phase units. Starters to have Hand-Off-Automatic switch and automatic re-start feature in event of power failure.

9. Unit Heaters

a. Cabinet Type: Division 16 shall wire to disconnect switch provided with unit.
b. Propeller type: Division 16 shall provide and wire service switch with overload protection.

11. All motors 1/3 HP and smaller shall be wired for 120 volt, 1 phase, 60 hz. Motors 1/2 HP and larger shall be wired for 208 volt, 1 phase, 60 hz, unless specifically shown otherwise.

1.06 PERMITS

A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.

B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

1.07 CODES, ORDINANCES AND PERMITS

A. All work performed under this Section of the Specifications shall be done in accordance with applicable National, State and local Codes, Laws and Ordinances. The following abbreviations are used for reference to standards which are to be followed:

AABC	Associated Air Balance Council
ADA	Americans With Disabilities Act
AMCA	Air Movement & Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
NEC	National Electrical Code
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriter's Laboratories

B. The latest issue of each Code in effect at the time of bidding shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

1.08 QUALITY ASSURANCE

A. Qualification of Workpersons

Use sufficient qualified workpersons and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of system throughout.

B. Work performed shall conform with all Local and State Rules and Regulations, as well as those of the National Fire Protection Association (N.F.P.A.).

C. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.

D. Expansion tank shall conform to ASME Section VIII Code.

E. Air separator shall conform to ASME Boiler and Pressure Vessel Code.

F. Welding standards shall conform to ANSI Boiler Code, Section IX, B31.1

1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. **All materials and equipment of the same classification shall be the product of the same manufacturer**, unless specified otherwise.

A. Any proposal for substitution of Mechanical equipment, materials or vendors shall be made in writing PRIOR TO OPENING OF BIDS, see Division 1. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" shall be defined to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.

B. Approval by Architect for such substitution shall not relieve Mechanical Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work

C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.

D. Materials and equipment determined as an "approved equal" and/or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. Manufacturer, model, etc.) specified.

E. Any additional cost(s) resulting from the substitution of equipment, regardless of acceptance by the Architect or Engineer, shall be paid by this Contractor. Additional costs may include, but not be limited to, electrical and/or structural alterations from the contract documents. Contractor shall be solely responsible to verify that substitutes will fit within the designated spaces provide while permitting adequate clearances for servicing of equipment as required by the manufacturers. Contractor shall, upon request from the Architect or Engineer of record, provide such verification of ample space and clearances in the form of drawings or any other manner requested.

F. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the State of Maine) when available. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

1.10 PLANS AND SPECIFICATIONS

Mechanical Contractor shall provide his sub-contractors with a copy of the ENTIRE portion of Part 1 of this specification, portions of this specification and copies of drawings which pertain to the equipment to be supplied at no cost to the sub-contractor. Provide ATC Contractor with entire set of Electrical plans and specifications. Provide Testing and Balancing sub-contractor with copies of shop drawings indicating coil gpm's, fan air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor's expense.

1.11 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD (.dwg and .dxf) files will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner or for any purpose other than for use pertaining to the construction of this project unless written permission is obtained.

1.12 SHOP DRAWINGS & SUBMITTALS

A. As soon as possible after award of Contract (but not longer than 21 calendar days), before any material or equipment is purchased, Mechanical Contractor shall submit to the Architect shop drawings for approval (see Division 1 for required quantities). If shop drawings are not submitted within the allotted time frame all substitutions included in the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Mechanical Contractor. Shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.

B. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.

C. All related items shall be submitted as a package. Partial submission shall not be reviewed until the package is complete, as itemized in paragraph "H" below.

D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his the contractor’s expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.

E. Mechanical shop drawings shall be separate from Plumbing shop drawings. All submittals shall have a clear area on the front no less than 4inches x 3inches to be reserved exclusively for the Engineers' shop drawing stamp or they will be refused for re-submittal.

F. Submittals must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.

G. Review must be obtained on the following items:

1. Ductwork and Accessories

a. Registers and grilles

b. Duct access doors
c. Volume control dampers (manual and automatic)
d. Duct sealant
e. Fire dampers and sleeves
f. Turning vanes
g. Flexible duct
h. Kitchen range hoods and accessories
i. Backdraft dampers
j. Louvers and brick vents - provide color chips (photocopies not acceptable) – provide samples if substituting
k. Filters
l. Vents from gas heating appliances
m. Exterior vent hoods from dryers, range hoods and exhaust fans where applicable.

2. Mechanical Equipment (sound data must be provided with all interior motorized equipment).

a. Full warrantee information must be included with all submittals.
b. Fans and accessories - provide full fan curves and computer selection printouts.
c. Cabinet unit heaters - provide color chips (photocopies not acceptable)
d. Horizontal unit heaters
e. Pumps and accessories - provide full pump curves and computer selection printouts.
f. Boilers and accessories, confirmation of start-up and State Inspection
g. Domestic hot water storage heaters and accessories
h. Equipment identification tags

3. Piping and Accessories

a. Pipe, valves, unions and flanges
b. Manual balancing valves with read-out gauge and pressure tappings. Provide a schedule clearly indicating every valve, its location, GPM, size and pressure drop.
c. Automatic Balancing valves
d. Air vents (automatic and manual)
e. Air separator
f. Relief valves
g. Expansion tank and accessories
h. Pipe hangers and insulated pipe supports
i. Pressure gauges and thermometers
j. Triple duty valves
k. Pressure reducing valves
l. Pipe flexible connectors
m. Pipe and valve markers
n. Backflow preventer
o. Flow control valves
p. Underground piping system
q. PEX tubing, fasteners, connectors, hangers and accessories

4. Terminal Units

   a. Finned radiation

5. Insulation

   a. Pipe
   b. Duct
   c. Pipe fittings
   d. Air separator

6. Automatic Temperature Control (ATC) System

1.13 PRODUCT HANDLING

A. Protection

Use all means necessary to protect heating and ventilating materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

1.14 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Mechanical Contractor, a record shall be made by the Engineers, and *the cost of the record shall be paid by the Mechanical Contractor*. Copies of the mechanical CAD drawings may be made available electronically to the Mechanical Contractor if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT". Contact the Architect directly or the Engineer via e-mail at mechsyst@maine.rr.com. Specify required CAD format when requesting the files. CAD drawings were generated using AutoCAD 2006 and utilize both paper space and model space with external references to various other drawings. Files will be compressed and will require "WinZip" (http://www.winzip.com) for extraction. A release form will be provided which must be signed and returned to the Engineer prior to transfer of files.

1.15 MAINTENANCE MANUAL

A. On completion of this portion of the work, and as a condition of its acceptance, submit for approval two copies of a manual describing the system. Mechanical equipment manuals shall be separate from plumbing manuals. All manuals shall be original copies, not photocopies or they will be refused for re-submittal. Prepare manuals in durable 3-ring binders approximately 8½ inches by 11 inches in size with at least the following:

1. Identification on the front cover and spine stating general nature of the manual.

2. Neatly typewritten index.

3. Complete instructions regarding operation and maintenance of all equipment involved.

4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name, address and telephone number of nearest vendor of parts.

5. Copy of all guarantees and warranties issued.

6. Where contents of manuals including manufacturer's catalog pages, clearly indicate the precise item included in this installation and delete, or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.

B. In addition to above, provide two (2) separate offset style binders properly identified, each containing a copy of all reviewed shop drawings and catalog cuts. (NOTE: May be incorporated in Maintenance Manuals, if binders are of adequate size.)

1.16 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Mechanical Contractor at no extra cost to the Owner.

1.17 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.

1.18 MINOR DEVIATIONS AND DISCREPANCIES

A. The drawings are intended to indicate only diagrammatically the extent, general character and approximate locations of mechanical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, plumbing and electrical drawings so that work under this section is properly installed and coordinated with other Sections.

B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the mechanical drawings, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.

C. Questions to the Architect or Engineers are encouraged, but any answers or advice is non-binding. Therefore, inquires about such items should be made at least 4 days prior to when bids are due to allow time for a clarifying addendum to be issued.

D. Any conflicts arising from duplication of equipment specified in different portions of the specifications shall be brought to the attention of the Architect prior to submitting bids. Failure to do so does not relieve the Contractor from responsibility of providing said materials and equipment and a credit will be taken for the duplicated item(s).

1.19 CHANGE ORDERS

A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.

B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

1.20 COORDINATION

A. Contractor shall be responsible to coordinate his work with that of other trades to adjust to field conditions prior to commencing work. If a reasonable solution cannot be achieved without compromising the integrity of the intended design or would result in additional cost the Architect must be notified immediately prior to commencement of work. Failure to do so does not relieve the Contractor from providing and installing the systems to the satisfaction of the Architect at no additional cost.

B. Contractor shall be responsible to review job conditions and identify conflicts and/or obstructions to ductwork and piping prior to fabrication. If conflicts and/or obstructions are noted the Architect must be notified immediately prior to commencement of work. The cost of any fabrication work performed without confirmation and notification of conflicts and/or obstructions shall be the responsibility of the contractor.

1.21 WORKPLACE SAFETY

Mechanical contractor shall be responsible for the safety of his workpeople.

PART 2 - PRODUCTS

2.01 PIPING

A. General

Provide and erect in accordance with best practice of trade all hot water supply, hot water return, drain and vent piping shown on the plans and as required to complete intended installation. Contractor shall make offsets as shown or required to place all piping in proper position to avoid other work, and to allow application of insulation and finish painting.

B. Pipe Materials:

1.	Heating hot water, 2½ inches and larger.	Schedule 40 standard weight black steel, ASTM 12
2.	Heating hot water mains, 2 inches and smaller, cold water, drains from relief valves and automatic vents.	Type “L” hard drawn copper tubing with sweat fittings.
3.	Heating water runouts to radiation, above grade, 180^{o}F.maximum.	PEX crosslinked flexible tubing, ASTM F876 and F877.

C. Pipe Fittings:

1.	Screwed	ASTM 125# cast iron screwed, ASTM A126, ASA B16.1
2.	Welded	Standard weight butt weld carbon steel, ASTM A234, ANSI B16.9 from A106 Gr. B. seamless Tube
3.	Unions	250 malleable iron, brass to iron seats
4.	Flanges	150# forged steel slip-on ASTM A234
5.	Sweat	Cast bronze or wrought copper made up with 95-5 solder
6.	Connections to equipment	2 inches and smaller – unions, 2 ½ inches and larger – flanged.

D. All heating hot water mains 2½ inches and larger shall have welded connections using standard factory-fabricated tees, elbows, reducers, and caps. Branch outlets in welded sizes shall be made with tees for full size or one size reduction and with either "Weldolets" and "Threadolets" or factory shaped nipples for all other sizes. All welds shall be made by welders certified by the State of Maine and shall be capable of welding in any position "in the field". All welds shall conform with the rules set forth in the Standard Manual on Pipe Welding of the Heating, Piping and Air Conditioning Contractors national Association. All slip on fittings shall be back welded. Fire extinguishing equipment shall be kept within 25 feet of welding areas at all times. Contractor shall take additional measures when welding close to wood structures to protect the wood from igniting.

E. All metallic piping 2 inches in size and smaller shall be type "L" hard drawn copper tube with sweat fittings.

F. The Mechanical Contractor may, at his option, use schedule 40 standard weight black steel, ASTM 12, with threaded fittings for piping 2 inches and smaller in lieu of copper. The option of steel or copper MUST be stipulated in the bid and thereafter no deviation will be acceptable. If steel is to be used, the piping system shall be 100% steel with no mixture from copper to steel.

G. The Mechanical Contractor may also, at his option, use an IPS Grooved Piping System in lieu of welded, flanged and threaded connectors for steel piping 2½ inches in size and larger. If this system is to be utilized contractor must state so very clearly in his bid and the system shall be 100% grooved. System shall employ grooved mechanical pipe couplings, fittings, valves and other grooved components. All grooved components shall be of one manufacturer, and conform to local code approval and/or as listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC, FM, IAPMO or BOCA. Grooved end product manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476. System shall be by Victaulic or approved equal.

1. Pipe shall be Schedule 40 standard weight black steel, ASTM 12 - Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with Victaulic current listed standards conforming to ANSI/AWWA C-606.

2. Mechanical couplings shall be manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade “E” EPDM. There shall be two type of couplings utilized:

   a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13. Victaulic Style 07 (Zero-Flex®).

b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three Couplings shall be placed in close proximity to the vibration source. Victaulic Style 75 or 77.

3. Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741.

4. Grooved End Fittings: Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12.

5. Hole-Cut Branch Outlets: Branch reductions on 2 inch through 8 inch header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic Style 920 / 920N.

6. Grooved End Valves

a. Butterfly Valves are not permissible.
b. Ball valves in 2½ size shall be lever operated, 1,000 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Ball shall be chrome plated carbon steel with chrome plated carbon steel stem. Victaulic 726.
c. Check valves in 2½ inch size shall be spring assisted, PPS coated ductile iron body, ASTM A-536, Grade 65-45-12, aluminum bronze non-slam tilting disc, stainless steel spring and shaft, EPDM rubber seat, 300 psi (2065 kPa). Victaulic Series 716.

7. Grooved End Specialties

Dielectric waterways: 1 inch through 8 inch sizes, grooved, plain end, or threaded end, ASTM A-53 carbon steel or ASTM A-536 ductile iron body, zinc electroplated, with LTHS high temperature stabilized polyolefin polymer liner. Victaulic Style 47.

8. Assembly

a. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove.
b. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.
c. See the latest copy of Victaulic's Field Assembly and Installation Instruction Pocket Handbook (I-100).
d. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

e. Manufacturer shall provide on-site training for contractor's field personnel by a factory-trained representative in the proper use of grooving tools, application of groove, and product installation. Manufacturer's authorized representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

2.02 VALVES

A. General

1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation, locate to permit easy operation, replacement and repair. All pressures specified are steam working pressure.

2. All valves must be so constructed that they may be repacked under pressure while open.

3. Globe valves shall be installed in all lines where regulation is required.

4. Check valves shall be installed in all lines where flow may reverse from intended direction.

5. Except for above or as otherwise noted on drawings, ball valves shall be installed in all supply and return lines and on all drain lines.

6. All valves to comply with federal specifications and be so listed.

7. Butterfly valves shall not be used.

B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

1. Gate Valves 2 inches in size and smaller shall have bronze bodies, rising stem, solid wedge, union bonnet, rated for 150# WSP, 300# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1169	1151
Stockham	B-124	B-120
NIBCO	S-134	T-134
Hammond	IB648	IB629

2. Globe Valves 2 inches in size and smaller shall have bronze bodies, union bonnet, renewable composition disc for service intended, rated for 150# WSP, 300# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1590-T	590-T
Stockham	B-24-T	B-22-T
NIBCO	S-235-Y	T-235-Y
Hammond	IB423	IB413T

3. Globe Valves (non-Victaulic) 2½ inches in size and larger shall have iron bodies, union trim, OS&Y, bolted bonnet, solid disc, gland packed, flanged ends. Rated for 125# WSP, 200# WOG:

	Flanged Ends
Milwaukee	F-2981
Stockham	G-512
NIBCO	F-718-B
Hammond	IR116

4. Plug type Globe valves 2 inches in size and smaller shall have bronze bodies, union bonnet, stainless steel plug type disc and seat. Rated for 150# WSP, 300# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	591-A	
NIBCO	T-256-AP	

5. Ball valves 1¼ inches in size and smaller shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats an seals, blow-out proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350^{o}F:

	Soldered Ends	Screwed Ends
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	------	------
Hammond	8614	8604

6. Ball valves 1½ and 2 inches in size shall have bronze bodies, two piece, standard port, Type 316 stainless steel stems and balls, reinforced Teflon seats an seals, blow-out proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Rated for 400# Bar non-shock cold working pressure.

	Soldered Ends	Screwed Ends
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-580-66	T-580-66
Hammond	8513	8503

7. Ball valves (non-Victaulic) 2½ inches in size and larger shall have carbon steel bodies, Type 316 stainless steel stems, Type 351 stainless steel balls (vented), glass filled Teflon seats and seals and blow-out proof stems. Shall be equipped with suitable packing for service intended. Rated for 150# WOG and 350°F:

	Flanged Ends
Apollo	88-140
Watts	CF-1500-150-02-T316
NIBCO	F-510-CS-R-66-FS

8. Ball valves for grooved piping systems – see 2.01, G, 6, "Grooved end valves:.

9. Check Valves 2 inches in size and smaller shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

	Soldered Ends	Screwed Ends
Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

10. Check valves (non-Victaulic) 2½ inches in size and larger shall be horizontal swing type with iron body, bronze trim and flanged ends. Rated for 125# WSP, 200# WOG:

	Flanged Ends
Milwaukee	F-2974
Stockham	G-931
NIBCO	F-918-B
Hammond	IR1124

2.03 INTERIOR HANGERS AND SUPPORTS

A. General

1. All interior hangers and supports shall be specially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.

2. Piping specified shall not be supported from piping of other trades.

3. Hangers shall be steel, adjustable clevis type; plain for steel pipe and copper plated for copper tubing. Carpenter & Paterson, Inc., Fig. 100 (Fig. 100 CT copper plated) or approved equal. Hangers on hot water and drain piping shall be sized for the piping only (not including insulation). Hangers on cold water piping, and where specifically indicated on drawings, shall be sized to include the insulation and include thermal hanger shields (insulated pipe supports).

4. Thermal hanger shields shall be Carpenter & Paterson, Inc., Fig. 265P or approved equal.

5. Exposed vertical risers ¾ inch and smaller shall be supported at the mid-point between floor and ceiling with split ring type hangers; copper plated for copper tubing. Carpenter & Paterson, Inc., Fig. 81 (Fig. 81 CT copper plated) or approved equal.

6. Piping suspended from walls, trench walls and partitions shall be supported by steel support bracket. Carpenter & Paterson, Inc., Fig. 69 or approved equal.

7. All steel hangers shall be factory painted.

8. Supports for PEX tubing shall be designed specifically for PEX material, provided and approved by the tubing manufacturer.

B. Hanger Rods

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

Pipe Size	Rod Size
½" to 2"	3/8"
2½" to 3"	1/2"

2. Provide toggle bolts for fastening to concrete blocks and compound anchor shields for bolts for fastening to poured concrete.

3. Provide lag points with rod couplings or side beam connectors with drive screws for fastening to wood.

4. All nuts for hanger rod to be stainless steel.

C. Supports

Provide and install angle iron supports for pipe hangers as required. Angle iron supports shall be adequate size for span and piping or equipment load.

2.04 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Mechanical Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than the pipe. Pipe passing through walls other than masonry shall be provided with #24 gauge galvanized steel tubes with wired or hemmed edges.

2. Sleeves set in concrete floor shall finish flush with the underside, but extend a minimum of 1 inch above the finish floor. Sleeves set in partitions shall finish flush with each side.

3. Spaces between sleeves and pipes within building shall be sealed fire and smoke tight. Material shall be 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant, or approved equal. Sealant material shall be U.L. listed.

B. Escutcheons

Where uninsulated piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates. Provide deep type floor plates as required for projecting sleeves. Piping through walls with insulation or where concealed shall not require escutcheons.

2.05 ANCHORS

Anchors shall be provided and installed as detailed and shown on the drawings, or as required to control expansion.

2.06 PAINTING

Painting shall be provided for all equipment supports, steel gas piping within boiler room, exposed flanges, fittings and valves within boiler room and mechanical rooms and where specified elsewhere within this section. Temperature control devices *shall not* be field painted.

Painting shall consist of no less than two (2) coats of rust inhibiting paint, Rust'O'leum or approved equal. Fuel oil piping shall be covered with no less than two (2) coats of industrial epoxy designed for resistance to fuel oils. Paint shall be capable of withstanding temperatures of up to 250^{o}F.

Colors shall be as follows:

Equipment supports, exposed flanges, fittings and valves Flat black

All exposed unpainted metal parts of boilers, including foundation, headers and nipples shall be painted with one (1) coat of asphaltic base black paint. Metal shall be thoroughly cleaned of grease, oil, pipe compound, plaster and other dirt before application of paint.

2.07 POLYETHYLENE (PEX) HEATING HOT WATER PIPING - ABOVE GROUND

A. General

Furnish and install complete system of pre-manufactured piping as shown on plans. The system shall consist of flexible crosslinked polyethylene tubing known in the trade as PEX. Tubing shall meet ASTM F876 and F877 standards and shall be capable of service temperatures up to 200^{o}F. and working pressure to 100 psi.

B. Construction and Components

The carrier pipe shall be PEX flexible crosslinked tubing, internal diameter as indicated on drawings. Connections to copper piping shall be by the tubing manufacturer and be sweat connectors and connections to steel piping shall be threaded connectors, all provided by the tubing manufacturer and installed in strict accordance with manufacturer’s instructions.

Insert fittings shall be copper or brass, ASTM F 1807
Crimp rings shall be copper (black for PEX systems), ASTM F 1807

C. PEX tubing must be labeled (on the tubing) as follows:

1. The manufacturer's name or trademark
2. The standard to which it conforms (ASTM F876, F877, or both)
3. Tube size and CTS
4. Material designation code (PEX0006)
5. Pressure/temperature rating(s)
6. SDR9

The marking interval shall be not more than five feet.

2.08 HOT WATER SPECIALTIES

A. Manual (Adjustable) Balancing Valves

1. Return mains and elsewhere as indicated shall be provided with a balancing valve equipped with readout valves to facilitate the connecting of a differential pressure meter where indicated (locate on return lines at each duct coil). Each readout valve shall be fitted with an integral EP check valve designed to minimize system fluid loss during the monitoring process. Each balancing valve shall have an indexing pointer and calibrated name plate to indicate the degree of closure of the precision machine orifice. Each balancing valve is to be constructed with internal O-ring seals to prevent leakage around the rotating element.

2. Valves shall be sized with an operating pressure differential range of 1.50 psig (minimum) to 2.00 psig (maximum).

3. Provide a schedule clearly indicating <u>every</u> valve, its location, GPM, size and pressure drop.

4. Each balancing valve shall be Taco Circuit Setter with a working pressure of 175 psig and a maximum operating temperature of 250^{o}F. Units by Bell & Gossett or Tour and Anderson will be considered.

B. Automatic (Preset) Balancing Valves

1. All finned radiation, convectors, cabinet unit heaters, unit heaters, unit ventilators and elsewhere as indicated, shall be provided on the return line from each unit with a balancing type valve equipped with readout taps to facilitate the connecting of a differential pressure meter. Valve body shall include a handle ball valve, Y-strainer, flow control cartridge assembly, two (2) pressure/temperature plugs, inlet union and outlet union. Valve bodies shall be line size.

2. Design

a. The GPM for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within 5% of the specified amount.

b. For ½ inch to 2 inch sizes the flow cartridge shall be removable from the Y body housing without the use of special tools to provide access for regulator changeout, inspection and cleaning without breaking the main piping (Access shall be similar to that provided for removal of a Y-strainer screen).
c. True operating ranges of 2 - 32 psid or 5 - 60 psid are required. The design flow should be achieved at the minimum psi differential. A 50% safety factor applied to the lower operating range is not acceptable.
d. Each valve shall have two PIT ports.
e. All automatic flow control devices shall be supplied by a single source and certified flow tests, witnessed by a professional engineer, shall be available.
f. Provide factory product warranty of not less than five (5) years and free first year cartridge exchange.

3. Construction

a. Internal wear surfaces of the valve cartridge shall be electroless nickel or stainless steel.

b. Internal flow cartridge body shall have machined threads so the spring free height may be compensated for without the use of fixed shims. A crimped sheet metal design is not acceptable.
c. Internal flow cartridge shall be permanently marked with the GPM and spring range.
d. For ½ inch through 2 inch pipe sizes: An assembly shall consist of a brass Y-type body, integral brass body ball valve and '0' ring type union. Flow Design “AutoFlow” Model AC or approved equal.
e. For 2½ inch pipe sizes and larger: Ductile iron body suitable for mounting wafer style between standard 150# or 300# flanges. The long flange bolts and nuts shall be provided with each control valve. Flow Design “AutoFlow” Model WS or approved equal.
f. All valves shall be factory leak tested at 100 psi air under water.

4. Minimum ratings

½ inch through 2 inch pipe size: 400 PSIG at 250DF

5. Flow Verification

a. Where indicated on the plans, the differential pressure across the Automatic Flow Control Valve shall be measured for flow verification and to determine the amount of system over heading or under pumping.
b. Flow shall be verified by measuring the differential pressure across the coil served or the wide open temperature control valve and calculating the flow using the coil or valve Cv.

6. Test Kit

A differential pressure test kit shall be supplied to verify flow and measure overheading. The kit shall consist of a 42 inch diaphragm gauge equipped with ten foot hoses and P/T adapters all housed in a vinyl case. Calibration shall be 0-35 PSID for 2-32 PSI spring range or 0 - 65 PSID for 5-60 PSI range.

7. Installation

   a. Install automatic flow control valves on the return lines of equipment as indicated on the plans. Balancing valve on supply side is not acceptable.
   b. The standard ports and handles shall clear 1 inch thick insulation. Handle and port extensions are required for over 1 inch thick insulation.
   c. Install, on the supply side of coils, a Y strainer with a brass blowdown valve with ¾ inch hose end connection with cap and chain.

C. Radiator Valves

All radiation loops shall be provided with ball valves on both supply and return ends for 125 psig at 250°F. as specified under valves.

D. Drains

Each downfeed convector, cabinet unit heater, unit heater, coil and unit ventilator shall be provided with a drain valve between the shut-off valves and heating equipment at the lowest point in the piping. All low points in piping mains shall be provided with drain valves. Drain valves shall be ball valves as specified under VALVES with hose connections and metal caps. Drain finned radiation with easily accessible drain couplings or drain elbows.

E. Air Vents

1. Air vents shall be installed at the equipment, all high points in the piping as indicated on the plans or as may be required.

2. Automatic air vents shall be Taco 409 brass vent. Units by Anderson, Armstrong (No. 1-AV) or Sarco will also be considered. Pet cocks shall be installed with each unit and the drains from the vents shall be run as indicated on the plans. An air chamber shall be installed at each air vent and shall be line size for all piping up to 2 inches in size; 2 inch for larger piping. Do not use on glycol systems, use manual vents only.

3. Manual air vents shall consist of air chamber with a Dole No. 14A Coin Valve with copper tube extension. Install valve in accessible location.

4. By-pass type vents shall be installed where shown and as detailed on the drawings. By-pass valves shall be plug-type globe as specified under VALVES.

F. Expansion Tank

Furnish and install vertical pressurized replaceable bladder type water expansion tank pre-charged to pressure indicated on drawings. Tank shall be constructed of steel for 125 psi working pressure in accordance with ASME Code, and have the necessary tappings for water connections and charging valve. Tank shall be furnished with ASME stamp and certification papers. A copy of ASME certification shall be provided with equipment submittal.

1. Tank shall be installed with a manual shut-off valve between the tank and the system and a union between the tank and the valve.

2. Tank shall be Taco CAX series. Units by Bell & Gossett or Wood will be considered. Capacities shall be as shown on drawings and are minimums.

G. Backflow Preventer

Backflow preventer shall be furnished under division 15400, "PLUMBING".

H. Water Pressure Reducing Valve

Furnish and install a pressure reducing valve with brass body construction and built-in strainer in the cold water piping connected to hot water heating system as shown on the drawings. The valve shall be adjustable and be No. 335, as manufactured by Taco. Units by Bell & Gossett and Watts will be considered. Provide pressure relief valve with operating pressure 100% over system pressure, but not exceeding 100 psi.

I. Flow Control Valve

Furnish and install flow control (flo-check) valves with line size cast iron body and threaded ends for pumps P-4, P-5 and P-6. Working parts shall be easily removable for inspection and cleaning without removing valve body from the pipeline. Taco Model "Flo-Chek" or approved equal by Bell & Gossett.

J. Air Separator

Furnish and install Taco AC25F in-line air separator. The unit shall be flanged and contain a removable strainer and blow down. Unit to be constructed in accordance with A.S.M.E. boiler and pressure vessel code and stamped 125 psig design pressure. Equal equipment by Bell & Gossett will be considered.

K. Flow Metering Station

1. Provide and install a flow metering station in the combined discharge of pumps P-X & P-X as indicated on drawings.

2. Unit shall be designed to thread into a weld-o-let pipe tap.

3. Unit shall include a type 304 stainless steel tube, brass block and vales and all required mounting hardware. Maximum working pressure shall be 200 psig at a maximum temperature of 250^{o}F.

4. Unit shall be designed for the specific pipe size into which it is to be installed.

5. Unit shall be Taco Standard Metering Station 7026 or approved equal.

L. Pressure Gauges

Furnish and install pressure gauges with gauge cocks on piping where shown on drawings. Tubing to pressure gauges shall be of sufficient length to extend beyond pipe insulation and still leave enough space to easily operate the gauge cock. The dial range shall be such that the normal pressure shall be approximately midway of the dial. Gauges shall be Weiss Series 4CTS with 4½ inch dial size, stainless steel or cast aluminum case, with brass "T" handle cocks and bronze pressure snubbers. Units by Ashcroft, Nurnburg & Trerice will be considered.

Pressure range: Water Systems 0-60 psi

M. Thermometers

Furnish and install where indicated on the drawings and in Part 3 - EXECUTION, dial type thermometers with stainless steel case, 4½ or 5 inch dial size, bimetal, universal angle type. Thermometers shall be Weiss 5VBM series. Units by Ashcroft, Nurnburg & Trerice will be considered. Provide and install thermometer wells on supply and return branch piping to duct reheat coils (when present) and two thermometers in boxes for the Owner's use.

Temperature Range: Heating System… 30^{o}F. - 240^{o}F.

2.09 DOMESTIC HOT WATER STORAGE TANKS AND HEATERS

A. Storage Water Heaters

Furnish and install hot water storage tank and heaters complete with all accessories as shown on drawings.

B. Tanks

Tanks shall have sizes and capacities as indicated on drawings, installed in a vertical position and constructed of 316L stainless steel in accordance with the ASME Code for Unfired Pressure Vessels to withstand a working pressure of 150 psi. Tanks shall be provided with a heating element, aquastat control tapping, cold water inlet and drain, hot water outlet and T&P relief valve connection. The heating element in the tank shall consist of a 90/10 cupronickel coil. Storage tank shall be covered with a 2 inch thick closed cell foam insulation. Outer covering shall be heavy duty rigid plastic. The entire unit shall carry a manufacturer's lifetime warranty. All connections shall be standard I.P.S. threads. The tanks shall be the dimension as shown on drawings.

C. Relief Valve

ASME temperature and pressure relief valves shall be provided and installed on the domestic hot water outlet by section 15400, "PLUMBING"

D. Units to be Super-Stor Model SS or approved equal.

2.10 CIRCULATING PUMPS

A. Circulating Pumps P-1 and P-2

1. Furnish and install hot water circulating pumps of the type, size and capacity shown on drawings. Pumps shall employ ECM technology, Wilo Stratos or approved equal.

2. Pumps shall be wet rotor, glandless inline circulating pumps and shall include electronic variable speed control to operate at constant/variable differential pressure control without external sensors.

3. Materials and Construction

   a. Circulating pumps shall be constructed with Cast-Iron bodies with factory applied Catephoresic coating.
   b. Shafts shall be constructed of high quality stainless steel. Motor bearings shall be metal impregnated carbon sleeve bearing type. Impellers will be constructed of a high strength, glass filled polypropylene engineered composite.

4. Pumps shall include the following features:

   a. Integrated synchronous motors using ECM technology with permanent magnetic rotors, sensorless control electronics and single phase electronic converters.
   b. Infra-red (IR) interface for wireless communication and an infra-red monitor.
   c. Integrated overload motor protection.
   d. Fault contact “FC” terminals shall be included in the terminal box and are to be potentially free, normally closed contacts that open on the event of a failure.
   e. Interface (IF) modules shall be included and installed in the terminal box. Modules shall permit BMS communication via LONworks, 0 – 10 volt DC control of speed and head setpoint, external minimum speed, external off, dual pump communication and pump operation status.
   f. Internal programming to regulate pump on/off operation based on outdoor temperature.
   g. Internal programming to regulate pump speed in response to changes in system pressure.
   h. Internal programming to provide lead/lag operation for pumps. Mechanical contractor to provide interface wiring between pumps.

5. Pumps shall have a terminal box with NPT electrical connections and a secure, gasketed cover, Class 2 protection level. Include on the face of the terminal box cover a single adjustment button, front readable graphical pump display, field adjustable for horizontal or vertical positioning of the terminal box. The display shall indicate:

   a. Operation status
   b. Control mode

c. Differential pressure or speed/setpoint
d. Fault and warning signals

6. Pumps shall have a coded terminal strip indicating common/neutral/ground within the terminal box for field connections for single phase 230 volt, 60 Hz power.

7. Electrical

a. Motor shall be a minimum of class H winding insulation as defined by UL 778.
b. Voltage variances shall be less than +/- 10% from rated voltage with pump under load conditions. Maximum amperage not to be exceeded is indicated on the pump nameplate. Electrical power to the pump is confirmed when the face of the graphic display is lit.

B. Circulating Pumps P-3, P-4 and P-5

1. Furnish and install hot water circulating pumps of the type, size and capacity shown on drawings. Pump shall be TACO 00 Series Horizontal cartridge design. Pumps by Armstrong, Bell & Gossett or Weinman will be considered.

2. Pumps to be single stage, cast iron bronze fitted construction. Pump shall incorporate a disc type lubrication system and be so designed that the bearing assembly can be removed in one piece.

3. The impeller shall be one piece cast bronze, enclosed type, dynamically and hydraulically balanced and keyed to the shaft. Pump shall have a two piece mechanical seal assembly easily replaceable without the use of special tools.

4. Pump bearing frame assembly, as well as the motor, shall be furnished with oil-lubricated sleeve bearings with readily accessible lubrication fittings.

5. Pumps shall be factory tested at the operating condition, name plated for quiet operation as a unit, thoroughly cleaned and painted with one coat of machinery enamel prior to shipment. A set of installation instructions shall be included with at the time of shipment. Motor shall operate at 1,750 RPM. A set of installation instructions shall be included with each pump at the time of shipment.

2.11 BOILER UNITS

A. Furnish and install where shown on the drawings, condensing, direct vent natural gas fired boiler units. Units shall condensing type with stainless steel burners. Units shall be wired for 120 volts, 1 phase, 60 hertz power, see “Boiler Schedule”, sheet M5.

B. Compliances

1. ASME Compliance: Boilers shall bear ASME "H" stamp and be National-Board listed.
2. FM Compliance: Control devices and control sequences according to requirements of FM.

3. IRI Compliance: Control devices and control sequences according to requirements of IRI.
4. Comply with NFPA 70 for electrical components and installation.
5. CSD-1
6. SCAQMD Rule 1146.2 for low NOx equipment
7. BACT Compliant (Best Available Control Technology)

C. Submittals

1. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.
2. Detail equipment assemblies and indicate dimensions, required clearances, and method of field assembly, components, and location and size of each field connection.
3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
4. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.
5. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
6. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams for each boiler.

D. Warranties

1. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide one year of warranty parts and labor.
2. Special Warranty: Submit a written warranty, executed by the contractor for the heat exchanger.
3. Warranty Period: Manufacturer’s standard, but not less than 10 years from date of Substantial Completion on the heat exchanger. Warranty shall be non-prorated and not limited to thermal shock.

H. Components

1. Cast Aluminum Block
2. 30 PSI ASME Relief Valve
3. Drain Valve
4. Stainless steel burner.
5. Direct Spark ignition
6. Variable Speed Blower Assembly
7. Negative Pressure Regulated Gas Valve.
8. 50 VA Transformer
9 Dual Scal T&P Gauge
10. Outlet water temperatue sensor
11. Inlet Water Temperature Sensor
12. Flue gas Temperature Sensor
13. Outdoor Temperature Sesnsor.

14 System Water Temperature Sensors

I. Burner and gas train

1. Burner Firing: Full modulation with 5:1 turndown @ Continuous CO2
2. Burner Ignition: Intermittent spark
3. Safety Controls: Energize ignition (14,000 Volts), limit time for establishing flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, and allow gas valve to open.
4. Flue-Gas Collector: Enclosed combustion chamber with integral combustion-air blower and single venting connection.
5. Gas Train: Manual gas valves (2), main gas valve (solenoid), 'B' valve, pilot gas pressure regulator, and automatic pilot gas valve. All components to be factory mounted.
6. Safety Devices: Low gas pressure switches, air-flow switch, and blocked flue detection switch. All safeties to be factory mounted.

K. Motors

Open drip-proof motors where satisfactorily housed or remotely located during operation. Blower motor shall be externally mounted for ease of service. There shall be no requirement to remove covers or gas train components to remove the blower motor. Blower motor shall not exceed ½ HP and not require more then 5 amps.

L. Controls

1. Each boiler shall maintain set temperature as determined by its own internal controls. Temperature shall be reset according to outdoor temperature. Provide outdoor and boiler temperature sensors with each boiler.
2. A domestic hot water override shall be included to provide 180^{o}F. water whenever pump P-5 activates. ATC Contractor shall provide interface between pump controls and override cycle.
3. Controls shall include a "true run time" lead-lag controller to designate one boiler as the lead unit while the other boiler serves as stand-by. The lead boiler shall provide heat and domestic hot water as required by the heating system. Should the lead boiler not be able to meet load demands the stand-by boiler shall become active to supplement the lead boiler.
4. Either boiler shall activate pump P-3 or P-4 whenever the boilers are active. A flow switch mounted in the boiler shall verify flow before permitting boiler(s) to fire. ATC Contractor shall provide interface between pump control and boilers cycle.
5. Boiler manufacturer shall provide qualified personnel to install any controls and wiring requiring field installation. Installer shall work closely with the ATC Contractor to be sure interlocks between boiler controls and building controls are installed and functioning properly.

M. Units shall be Weil McLain Ultra Series 3, shipped in one piece on skids. Units by the following manufacturers will be considered:

1. Triangle Tube
2. Viessmann
3. Lochinvar

4. Buderus

N. Testing

Testing all pressure parts of the boilers shall be subjected to hydro-static tests according to ASME Code for low pressure boilers. Field tests shall be limited to maximum working pressure for which each boiler is intended. Contractor shall furnish all equipment, piping, water and labor necessary to perform such tests as may be required by the Boiler Inspector or as directed by Architect. Tests shall be of duration necessary to satisfy Boiler Inspector and Architect.

O. Startup and Commissioning

1. Engage a factory-authorized service representative to assist the Contractor with startup service. Start up to be performed only after complete boiler room operation is field verified to offer a substantial load, and complete system circulation. One-year warranty shall be provided by the manufacturer. One year's service shall be provided by the Contractor. Manufacturer shall also include pricing to provide a factory authorized technician for up to 4 service calls over that one year period.

2. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment Installer.
3. Complete manufacturer's installation and startup checklist and verify the following:

    a. Boiler is level on concrete base.
    b. Flue and chimney are installed without visible damage.
    c. No damage is visible to boiler jacket, refractory, or combustion chamber.
    d. Pressure-reducing valves are checked for correct operation and specified relief pressure. Adjust as required.
    e. Clearances have been provided and piping is flanged for easy removal and servicing.
    f. Heating circuit pipes have been connected to correct ports.
    g. Labels are clearly visible.
    h. Boiler, burner, and flue are clean and free of construction debris.
    i. Pressure and temperature gages are installed.
    j. Control installations are completed.

4. Ensure pumps operate properly.
5. Check operation of pressure-reducing valve on gas train, including venting.
6. Check that fluid-level, flow-switch, and high-temperature interlocks are in place.
7. Start pumps and boilers, and adjust burners to maximum operating efficiency.

    a. Fill out startup checklist and attach copy with Contractor Startup Report.
    b. Check and record performance of factory-provided boiler protection devices and firing sequences.
    c. Check and record performance of boiler fluid-level, flow-switch, and high-temperature interlocks.
    d. Run-in boilers as recommended or required by manufacturer.

8. Perform the following tests for each firing rate for high/low burners and for 100, 66, and 33 percent load for modulating burners. Adjust boiler combustion efficiency at each firing rate. Measure and record the following:

   a. Gas pressure on manifold.
   b. Combustion-air temperature at inlet to burner.
   c. Flue-gas temperature at boiler discharge.
   d. Flue-gas carbon-dioxide and oxygen concentration.
   e. Natural flue draft (if applicable).

9. Measure and record temperature rise through each boiler.

P. One Year Service

Each boiler-burner unit shall be provided with free service period of one (1) year after acceptance by Owner. This service will include parts replacement and repair, excluding normal maintenance and adjustment. This service shall be a factory authorized service.

2.12 VENT PIPE AND COMBUSTION AIR

A. Vent and combustion air pipe shall meet all requirements of a category IV positive pressure venting systems.

B. Provide fire stopping collar (provided by smoke pipe manufacturer) at each ceiling and floor as the vent rises through the building.

C. Vent pipe and accessories shall be PVC Schedule 40 Plastic

2.13 FINNED RADIATION

A. Finned pipe radiation shall consist of ¾ inch copper tube with aluminum fins. Each radiator shall have the finned length and heating capacity indicated on the drawings.

B. Covers for all types shall be not less than 18 gauge steel, residential style with full back plates and continuous dampers. Back plate (factory painted) shall be securely fastened to the wall studs with screws at 48 inch centers maximum. Elements shall be supported by approved slide cradles and universal brackets spaced a maximum of 48 inches on center. Provide return line hangers where shown on drawings. Covers shall have baked enamel finish in white color.

C. Unless shown differently on the drawings, the covers shall be a minimum of 1'-6" longer than the finned length. End covers or wall sleeve and wall sleeve supports shall be provided for each end of the cover.

D. All ratings shown on the drawings are based on 160°F. average water temperature with a 40°F. temperature drop and 2.0 gallons per minute flow rate. The following types are based on Sterling Radiator Co. to establish a standard:

1. FP-A: Single tier element, 9.13/16 inches high x 3.1/4 inches deep enclosure with return line hangers, ¾ inch copper tube, 2¾ x 2 ½ inch aluminum fins, 60 per linear foot. Sterling Senior.

E. Provide itemized list of exact amount of finned tube and cover to be provided in each room and output capacities with submittals.

F. Units by Haydon, Rittling and Vulcan will be considered. However, if capacities cannot be met in the lengths indicated, additional lengths must be provided to meet minimum required output at no additional cost.

G. The plans indicate locations that will require zone valves, ball valves and circuit setters in the enclosure. The mechanical contractor will need to supply and install end pieces that will accommodate these components (and in some locations return piping)

2.14 CONVECTORS

A. Convectors of the size and types listed on the drawings shall be provided and installed. They shall have removable front panels. Backs and end enclosures of the cabinets shall be constructed of not less than 20 gauge steel. Fronts and tops shall be of not less than 18 gauge steel, if less than 48 inches long and 16 gauge if 48 inches or longer. Elements shall consist of round seamless copper tubes, non-ferrous fins securely fastened to the tubing, taps at each end for venting on up-feed units and drains on down-feed units, with ratings as shown on the drawings. Cabinets shall have baked enamel finish in color to be selected by Architect. Provide not less than two (2) color chip cards with submittals (photocopies not acceptable). Ratings shown on the drawings based on 160°F. average water temperature with a 40°F. temperature drop as indicated on the drawings.

B. The following types are based on Sterling to establish a standard:

1. Fully recessed with front outlet and inlet grilles, four side overlapping front cover; Type FWG-A. Submittals must indicate the actual output after compensating for inlet grilles.

2. Surface mount, wall hung, flat top with front outlet grille and bottom inlet; Type W-A.

3. All units shall be firmly fastened to the walls.

C. Units by Dun-Ham Bush, Rittling, Trane Co. and Vulcan will be considered.

2.15 CABINET UNIT HEATERS

A. Cabinet unit heaters shall be provided and installed where shown and fastened securely. The units shall be mounted as indicated on the drawings and shall include multi-blade centrifugal fans with quiet operating three (3) speed high efficiency direct drive motor, insulated casing, coils of copper tubes with aluminum fins, tamper proof access door to motor control switch. Capacities indicated on drawings to be based on 180°F. inlet water with a 20°F. drop.

B. All units shall be provided with 3 speed fan switch and unit mounted disconnect switch with thermal overload protection, all factory installed and wired.

C. Cabinets shall be 18-gauge steel with exposed corners and edges rounded, easily removed access panels. Finish shall be factory applied baked enamel in color as selected by Architect on visible surfaces of enclosure or cabinet. Provide two (2) color chip cards with submittals

(photocopies not acceptable).

D. Cabinet insulation shall be 2 inch thick dual density bonded glass fiber. Exposed side shall be high density erosion proof material suitable for use in airstreams up to 4500 FPM.

E. Coils shall be evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220 degrees F.

F. Provide two (2) sets of 1 inch *pleated media* throwaway type filters for each unit as specified under paragraph 2.19, "FILTERS". One set to be provided WITH each unit from the manufacturer to be used during construction and the other set installed when project is completed.

G. Units shall be vertical configuration, floor mounted with hot water supply line aquastat provided by A.T.C. Contractor. Models indicated are Sterling. Equivalent models by American Air Filter, McQuay or Trane will be considered.

H. Shut-off valve, balancing valve, drain valve with metal cap and air vent shall be provided on each unit.

2.16 FANS

A. General

1. Fans with capacities and types shown on the drawings shall be provided and installed. All roof curbs, unless otherwise noted, shall be provided by the fan manufacturer and installed by the General Contractor. This Contractor shall furnish the General Contractor with the correct sizes of roof curbs bases for units supplied.

2. Fan selection shall be based on sloping portion of curve with spare capacity of 20% of total CFM and static pressure without increasing motor size. **Provide full fan curves with submittals that shown the entire operating range of the fan - not just the operating point. Fans that are submitted without this data will not be accepted.**

3. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be listed by the Canadian Standards Association Testing Laboratory (CSA). Sones indicated on drawings are maximum allowable.

4. All roof fans shall be provided by this Contractor with a continuous ½ inch thick neoprene rubber curb gasket covering the full thickness of the curb wall.

5. All fans shown with vibration isolators on drawings shall be provided with spring type unless otherwise indicated.

6. Motor operated dampers shall be furnished by ATC Contractor.

7. Wall caps shall be provided where indicated and shall include weather hoods extending to the bottom of the outlet. Units shall be 26 gauge (min) steel, primed for field painting and include a 0.020 inch damper with magnetic closure strips. Turn units over to General Contractor for final painting prior to installation. All

units for exhaust fans and range hoods shall be identical in appearance and shall be provided by Aldes Ventilation Corp. (http://www.americanaldes.com) 2000 Series or Artis Metals Company (http://www.artiscaps.com/exhaust.html). Wall caps provided with fans are not permissible unless they meet these design and construction standards.

8. Roof curbs shall be not less than 13½ inches high, insulated, self-flashing type designed for EPDM roofing systems. Curbs shall include a damper shelf and be structurally designed to adequately support no less than twice the weight of the equipment to be placed on them.

B. Types

1. In order to establish a standard, fan model numbers indicated below are based on Air King and Cook (unless noted otherwise). Equivalent units by Acme and Greenheck ONLY will be considered.

2. Exhaust fans (EF) shall be ceiling mounted, direct driven, centrifugal exhaust fan. Fans shall be Energy Star rated and include a ceiling radiation damper for use in fire rated ceilings. Units shall be Nutone or equal by Broan or Panosonic.

Fan housings shall constructed of 24 gauge galvanized steel. Motors shall be heavy duty, permanent split capacitor, 4 pole, thermally protected. A field wiring compartment with receptacle shall be standard. Blower wheel shall be centrifugal, one piece polymetric. Grille shall be cold rolled steel, powder coated white. Duct collar shall be 4 inch diameter, metal, with backdraft damper. Provide a field fabricated 4 inch to 6 inch diameter duct adapter for each fan.

Provide a switch and turn over to Div 16. for installation. Switch shall turn on both the fan and separate room light (separate) simultaneously. An adjustable delay timer internal to the switch shall permit the fan to continue operation for an additional 20, 40 or 60 minutes when the switch is turned off.

Fire damper assembly shall include a non-asbestos ceramic blanket and a replaceable 165°F. fusible link. Ceiling radiation damper shall be ULC classified and rated for a 3 to 4 hour fire resistance, U.L. listed 555C.

3. EF-1 shall be Cook ACE-D Series centrifugal roof exhauster. Fan shall be a spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator.

Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Bearings and drives shall be mounted

on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, *Balance Quality and Vibration Levels for Fans.*

Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. A disconnect device/switch shall be factory installed and wired from the fan motor to a junction box. Standard wiring shall comply with National Electric Code and NBFU Standards and the fan shall be listed by Underwriters Laboratories (UL705). Thermal overload protectors shall be standard.

Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

Accessories shall include:

a. Fully insulated roof curb with damper shelf
b. Gravity shutter
c. Hinged base

4. BF-1 Shall be a Fantech Model DBF4XL Dryer Exhaust Boosters.

Inline fan shall be of the centrifugal, direct driven type.

Construction

a. Fan housing shall be constructed of heavy gauge galvanized sheet metal.
b. Internal air straightening vanes shall be provided for maximum air performance.
c. Fan shall be supplied with externally mounted electrical terminal box and pre-wired terminal strip connections.
d. Capacitor shall be enclosed within the fan electrical junction box.

Motor

a. Motorized impeller shall be an external rotor type, class B insulation, totally enclosed permanent split capacitor type.
b. Bearings shall be permanently sealed self lubricating ball type.
c. Motor shall be equipped with automatic reset thermal overload protection.
d. Motor shall be acceptable for continuous duty.

Wheel

a. Fan wheel shall be of the backward inclined centrifugal type with a well designed inlet venture for maximum performance.
b. Motorized impeller shall be both statically and dynamically balanced as one intragal unit to provide for vibration free performance.

Switch

a. Integral positive pressure sensing switch shall be mounted on the fan and prewired to the terminal strip provided in fan electrical junction box.
b. Switch shall be set to 0.05' w.g. static pressure
c. Switch shall incorporate a delay-on-break timer cycle to maintain fan performance for intervals of 10 minutes until drying cycle is completed.

Performance

a. Fan performance shall be based on tests conducted in accordance with HVI.

Code Approval

a. Fan shall be tested and approved by UL for safety. Rating shall include approval for residential dryer exhaust and air stream temperature of at least 60 deg. c.

2.17 RANGE HOODS (RH)

A. Apartment kitchen range hoods shall be designed for under cabinet mounting, ducted operation, provided with (2) fluorescent lamps, 2 speed fan switch and light switch. Lamps to be provided with the units. Units to be 30 inches wide, baked-on white polyester finish with washable aluminum mesh grease filter.

B. Units shall be Nutone ESN1030WH or approved equal with rear and top knockouts for 10 x 3¼ inch ductwork with integral shutter. Adapters for transition to round ductwork shall be provided under par. 2.23, "SHEETMETAL". Units shall be configured as shown on plans and labeled as Energy Star compliant.

2.18 SHEETMETAL

A. General

The work under this section includes all the required sheetmetal and duct work, extensions for grilles, manual dampers, automatic counterbalanced (backdraft) dampers, deflectors, setting of control dampers, grilles, registers, , flexible connections, fire dampers, and louvers, as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

B. Ducts

1. The size of ducts marked on the drawings will be adhered to as closely as possible. The right is reserved to vary duct sizes to accommodate structural conditions during

the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. All ducts shall be arranged to adjust to "field conditions". The Sheet Metal Contractor shall coordinate his work with Division 16 and other trades.

2. Medium and low pressure ducts shall be constructed of galvanized steel in accordance with the following table of duct sizes OR the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct, whichever is stricter, unless otherwise shown on drawings.

Dimensions of Longest Side (inches)	Minimum Sheet Metal Gauge
Up thru 12	26
13 --> 30	24
31 --> 42	22

3. Methods of fabrication and installation shall be in strict accordance with guidelines set forth in the latest SMACNA Guide and Data Book for Low and Medium Pressure Duct Construction unless otherwise shown on drawings. Cross break all ducts with largest dimension being 18 inches and larger. Beaded ducts are not acceptable except for ductwork less than 18 inches in either direction.

4. All dampers and deflectors shall be a minimum of #22 gauge and stiffened as required. Splitter dampers shall not be acceptable.

5. All joints in ducts shall be made air tight, and all branches and turns shall be made with long radius elbows and fittings. Long radius elbows are defined as having a centerline radius of 12 times the width of the duct. If long radius elbows are not used, elbows 18 inches wide and larger shall be provided with fixed double wall airfoil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width. Square elbows less than 18 inches wide shall be provided with single wall turning vanes. Square elbows with outside corners cut at 45^{o} or rounded are not acceptable.

6. All ducts shall be installed with necessary offsets, changes in cross sections, risers, and drops which may be required. They shall be constructed with approved joints and be supported in an approved manner.

7. Round ductwork shall be constructed in accordance with the latest SMACNA HVAC Duct Construction Standards for round and oval duct construction. Ductwork larger than 8 inches in diameter shall employ spiral seams. All turns shall be made with smooth (not segmented), long radius elbows and fittings. All seams shall be type RL-5, grooved seam pipe lock or better. *Lap seams are not permissible*. Gauge thicknesses shall be as outlined in SMACNA for galvanized steel round duct gauge selections for maximum 2 inches w.g. static pressure. Ductwork shall be supported with full wrap-around band and single hanger strap as indicated in Figure 4-4 of the 1985 edition of the SMACNA HVAC Duct Construction Standards handbook.

8. Furnish and install flexible connections where indicated. Connections shall be made

from Ventglas neoprene coated glass fabric as furnished by Ventfabrics, Inc., or approved equal.

9. Every precaution shall be taken to keep interior of duct system free from dirt and rubbish and to protect all ducts and equipment during construction. At completion, this Mechanical Contractor shall thoroughly clean all equipment to the satisfaction of the Architect.

10. Spaces between ducts and wall, ceiling or floor construction shall be caulked to make smoke and water tight with 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant or approved equal.

11. Testing, Balancing and Leak Testing... See Part 3, EXECUTION

12. Requirements set forth in applicable codes (see part one) shall supercede SMACNA standards.

13. Wall caps shall be provided for exhaust fans and range hoods where indicated and shall include weather hoods extending to the bottom of the outlet. Units shall be 26 gauge (min) steel, primed for field painting and include a 0.020 inch damper with magnetic closure strips. Turn units over to General Contractor for final painting prior to installation. All units for exhaust fans and range hoods shall be identical in appearance and shall be provided by Aldes Ventilation Corp. (http://www.americanaldes.com) 2000 Series or Artis Metals Company (http://www.artiscaps.com/exhaust.html). Wall caps provided with fans are not permissible unless they meet these design and construction standards.

C. Grilles and Registers

Grilles and/or registers shall be installed at all air supply, relief, return and exhaust openings as shown. All units to be aluminum, except as noted, and provided with baked enamel finish to match color of grille or register and countersunk screw holes. Mounting screws shall be oval head type with head painted to match finish. Unless stated otherwise, the following list is based on model numbers of Anemostat to establish a standard of quality. Krueger, Price and Titus only will be considered for review. If substituting, certified sound criteria shall be included with submittals (and highlighted) indicating CFM and NC levels of each register and grille.

1. Supply Registers: Double deflection; X2HO with opposed blade damper and ¾ inch front blade spacing; front blades set horizontal.

2. Supply Grilles: Double deflection; X2H, ¾ inch blade spacing; front blades set horizontal.

3. Exhaust and Return Registers: X3HOD with opposed blade damper and 3/4 inch, 45° front blade spacing, front blades set horizontal.

4. Exhaust and Return Grilles: X3H with 3/4 inch, 45° front blade spacing, front blades set horizontal.

D. Louvers

1. All exterior louvers shall be extruded aluminum construction with interior bird screens and anodized in color to be selected by Architect. Provide not less than 2 color chip cards with submittals for review (photocopies not acceptable). Frames and blades shall a free area of not less than 47% (combination type) and 55% (stationary type) and no less than 0.081 inches thick. The following list is based on model numbers of Ruskin to establish a standard of quality; approved equal units by American Air Warming and Arrow are acceptable.

2. All louvers shall be stationary blade type. Units to be 6 inches deep with certified rating of zero water penetration at free area velocity of 900 FPM based on tests in accordance with AMCA Standard 500. Units 48 inches and less in width shall be Model ELF6375X. Units greater than 48 inches in width shall have drainable blades, Model ELF6375DX.

3. Frames of all louvers to be box type for mounting in masonry walls. with factory mounting flanges on head and side jambs with extended sill for units mounted in frame walls.

4. Louvers in doors shall be provided as a part of the door by the General Contractor.

E. Roof Exhaust Vents

Roof exhaust vents to be heavy gauge aluminum, curb mounted, removable hood, with inside bird screens. Curbs to be provided with vents. Acme Model LQV or approved equal.

F. Duct Sleeves

Provide aluminum duct sleeves through outside wall at all locations as shown on drawings.

G. Sealing of Ducts

All interior ductwork (except prefabricated grease ducts and welded duct) shall be sealed with low VOC water based duct mastic, either "MP" (Multi-Purpose), Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or United Duct Seal (United McGill Corp.) water base, latex or acrylic type sealant. All transverse joints to be continuously sealed. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. Duct tape, in any form or material, is also prohibited.

For exterior applications, "Uni-Weather" (United McGill Corp.) neoprene based sealant shall be used. No other sealants may be used.

All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3" wide open weave fiberglass tape. Sufficient additional sealant shall then be applied to completely imbed the cloth. All sealants shall be UL rated at no more than flame spread of 5 and smoke developed of 0. At contractor's option Hardcast 1602 sealant tape may be used in lap joints and flat seams.

H. Duct Access Doors

Hinged insulated access doors with seals shall be provided in ducts where indicated on drawings, or as required. Units shall be provided at each manual damper, motor operated damper, duct coil (both sides), duct mounted temperature control device and fire damper unless accessible through grilles and as shown on drawings. Units to be Ruskin Model ADH-22 for rectangular duct and Model ADR for round duct or approved equal by Elmdor.

I. Motor Operated Dampers

Motor operated control dampers mounted in ductwork shall be provided by ATC Contractor, but installed by this Contractor. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight seal between damper frames and ductwork.

J. Manual Dampers

1. See Part 3, EXECUTION for installation notes.

2. Manual dampers with smallest dimension 5 inches or less shall be shop fabricated, single 22 gauge blade, 3/8 inch rod, provided with position indicator and locking quadrant.

3. Manual dampers with smallest dimension larger than 5 inches but smaller than 11 inches shall be single blade steel, 16 gauge construction, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.

4. Manual dampers with smallest dimension larger than 11 inches shall be opposed blade steel, 16 gauge construction, linkage concealed in frame, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.

5. Dampers to be installed in aluminum ductwork shall be fabricated of aluminum or isolated from ductwork with rubber grommets between the damper and the duct to prevent oxidation between dissimilar metals.

6. Provide hand quadrants for <u>all</u> manual dampers, Ventline Model 560 or approved equal.

K. Backdraft Dampers

Except where provided with exhaust fans, provide and install automatic counterbalanced backdraft dampers where indicated on the drawings. Unit frames shall be channel type, constructed of 0.090 inch extruded aluminum. Blades shall be 0.025 inch formed aluminum with extruded vinyl edge seals. Unit shall employ aluminum blade linkage concealed in the frame and adjustable zinc plated counterbalance bar on blades (except on top blade). Units shall be capable of being mounted in any position, Ruskin Model CBD2 or approved equal. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight

seal between damper frames and ductwork.

L. Fire Dampers

1. Fire dampers shall be installed to comply with NFPA Code No. 90A and shall bear a U.L. label. Provide fire rated access door at each fire damper not accessible through grille.

2. All fire dampers to be provided by damper manufacturer with integral sleeves (where required) and mounting angles. Sleeves provided "in-field" are not acceptable. Models indicated are Ruskin to establish a standard:

   a. Wall and floor types; Model IBDT, style “B”.
   b. Wall type behind grilles; Model IBD20, Style G
   c. Ceiling type above registers and grilles, Model CFD2W.
   d. Ceiling type in range hood ducts, Model CFDR3W.

3. Provide factory mounted fusible links designed to melt at 165^{o}F. and close the damper.

4. Installation shall be in accordance with damper manufacturer's instructions.

2.19 FILTERS

A. All cabinet unit heaters with filter banks shall be provided with a minimum of three (3) sets of filters with pleated media. One set to be used during construction (and replaced by the Mechanical Contractor during construction if required as determined by the Clerk of the Works and/or the Mechanical Engineer). Second set to be installed a minimum of one (1) day and a maximum of three (3) days prior to testing and balancing and/or final inspection. The third set shall be turned over to the Owner in their original unopened shipping boxes for their future use.

B. Filters shall be Farr 30/30, Air Guard DP-40 or approved equal; 1 inch thick.

2.20 EQUIPMENT IDENTIFICATION

Tag each fan (except kitchen range hoods and toilet exhaust fans), circulating pump, boiler, unit ventilator, unit heater, cabinet unit heater, compressor/condenser unit and switch with rectangular engraved nameplates with white letters on black, Brady Corp., Seton Name Plate Corp. or approved equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.

Boiler nameplates shall be 4 inches by 1½ inches, Setonply Style No. M1774. On all other units nameplates shall be 2½ inches by ¾ inch, Setonply Style No. M1771.

Identify all heating hot water supply and return mains with "Set Mark" full snap-around pipe markers by Seton Name Plate Corporation or approved equal by Brady Corp. Markers shall include both identification and direction of flow. Use yellow background with black letters. Markers shall be no less than 10 feet apart except in mechanical room where they shall be not less than 20 feet apart. Identification shall read “Heating Water Supply” or “Heating Water Return” as applicable. Domestic hot and cold water piping shall be labeled differently from heating water piping.

Tag all valves (if not tagged by valve manufacturer) with 1½ inch round brass tags and #6 bead chains, Seton #M4506. Tag shall be consecutively numbered. Provide valve charts identifying valve number, valve identification and service. Mount charts in Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Identify ducts and fire dampers with ventmark HVAC markers.

2.21 INSULATION AND CONDENSATE PROTECTION

A. General

1. Insulation shall be provided for all new metallic hot water supply and return piping, outside air intakes, exhaust ducts, relief ducts and other insulation where shown on drawings.

2. Insulation systems shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

B. Hot Water Supply & Return Piping

1. All new metallic hot water supply and return piping, exposed, above ceilings, within walls, pipe chases or pipe enclosures, shall be insulated with heavy density fiberglass pipe insulation with 450°F. temperature rating and factory applied ASJ jacket. Longitudinal jacket flaps to be secured with flare type stainless steel staples. Cut insulation to include pipe hangers.

Insulation thickness for hot water shall be as follows:

Pipe Size	Insulation Thickness
½" - 2"	1"
2½ " and larger	1½"

2. All fittings shall be wrapped with fiberglass insulation and covered with a one piece PVC insulated fitting cover secured with flare type stainless steel staples.

3. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished net with covering to match jacket and secured with mastic.

4. All valves 2½ inches and larger shall be wrapped with fiberglass insulation, covered and finished neat with covering material to match ASJ jacket on pipe insulation and secured with mastic.

5. Valves less than 2½ inches in size, flanges and unions shall not be insulated. Exception: All valves for cold water application shall be insulated.

6. PEX tubing needs no insulation.

C. Duct and Equipment Insulation

1. Insulate the following ducts with 3 inches thick fiberglass duct wrap with factory applied vapor barrier facing:

   a. Ductwork from EF-1 (Elevator Machine Room) to the exterior wall.
   b. Intake plenum behind louver for SF-1 and boiler combustion air in Mechanical Room.
   c. Exhaust ducts connected to apartment range hoods from exterior walls to 72" inside building.
   d. Ducts connected to all indoor exhaust fans from exterior walls to 72" inside building.

2. Material to carry U. L. label. All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24 inches or wider, mechanical fasteners shall be provided approximately 12 inches O.C.

D. Air Separator

Air Separator shall be insulated with 2 inch thick heavy density fiberglass insulation with ASJ jacket. Insulation to be securely fastened. Finish cover insulation with 14 ounce re-wettable canvas. Note: Manufacturer's identification plates shall remain exposed with insulation material tapered down to plate and finished as specified above.

E. Condensate Protection

Solder or weld bottom and sides of ducts connected to outdoors to prevent water leaks from rain and snow. Seal duct wrap and liner to minimize condensation.

F. Installation

All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

2.22 AUTOMATIC TEMPERATURE CONTROL (ATC)

A. General

1. Furnish and install a complete system of electric/electronic temperature controls.

2. The control systems shall be provided and installed by trained control mechanics regularly employed in installation and calibration of ATC equipment by the manufacturer or manufacturer's franchised dealer of temperature control equipment.

   NOTE: Control installation is not acceptable by wholesalers, contractors or by any firm whose principal business is not directly involved with the manufacture and installation of ATC systems.

Approved manufacturers and vendors are as follows

a. T.A.C.
Maine Controls
400 Presumpscot Street
Portland, Maine 04103
(207) 774-0220

b. Honeywell, Inc.
501 County Road
Westbrook, Maine 04092
(207) 775-3501

c. Trident, Inc.
187 Gray Road
Cumberland Center, Maine 04021
(207) 829-4001

d. Johnson Controls
39 Salem Street
P.O. Box 840
Lynnfield, MA 01940
1-800-288-1028, ext. 4478

3. Shop drawings of entire control system shall be submitted for approval before work is started. ATC Contractor is required to attend a meeting with the Engineer, Mechanical Contractor and Commissioning Agent along with a preliminary copy of the ATC shop drawings for the purpose of coordination.

4. Provide ATC technician to test the complete ATC systems sequences for specified cycles of operation with the Testing and Balancing Contractor.

5. ATC Contractor must, at the end of the warranty period, furnish the Owner with all access codes and passwords assigned to the ATC control systems. ATC Contractor shall also instruct the Owner in the use and operation of the entire control system, including any software all control software that may be utilized (including a backup copy of the final software package to the Owner on CD), see paragraph F, “Instruction and Adjustment”.

B. Scope

Control system shall consist of all area thermostats, air stream thermostats, valves, dampers, damper operators, relays, transformers, labor, 7 day program clocks and other accessory equipment, and a complete system of wiring to fulfill intent of ATC specification. Control shall be provided for, but not limited to the following:

1. Direct radiation
2. Fans operated by automatic temperature control system
3. Cabinet and horizontal unit heaters
4. Control of circulating Pumps.
5. Control of domestic hot water

C. Incidental Work by Others

1. The following incidental work shall be furnished by the designated contractor under the supervision of the Control Contractor.

a. Mechanical Contractor shall:

(1) Install automatic valves and separable wells that are specified to be supplied by the Control Contractor.
(2) Furnish and install all necessary valved pressure taps, water, drain and overflow connections and piping.

b. Sheet Metal Contractor shall:

(1) Install all automatic dampers.
(2) Provide necessary blank-off plates required to install dampers that are smaller than duct size.
(3) Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
(4) Provide access doors or other approved means of access through ducts for service to control equipment.

c. The General Contractor shall:

(1) Provide all necessary cutting, patching and painting.
(2) Provide access doors or other approved means of access through ceilings and walls for service to control equipment.

d. Division 16 shall:

(1) Provide wiring as described in Fan Schedule on sheet M-X.
(2) Wire power to all motor operated dampers.

D. Electric Wiring

1. All low voltage and data wiring for installation of temperature controls shall be by ATC Contractor, except as noted. Power wiring for equipment shall be by Division 16, "ELECTRICAL". See Part 1, Paragraph 1.05, sub-paragraph C, 'MECHANICAL ELECTRICAL WORK" for specific requirements.

2. ATC Contractor shall be responsible for coordinating installation of his wiring conduits with Division 16, "ELECTRICAL".

E. Submittal Brochure

1. The following shall be submitted for approval:

a. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
b. Panel layouts and name plate lists for all local and central panels.

c. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
d. Product data for all control system components.

F. Instruction and Adjustment

Upon completion of the project, the ATC Contractor shall:

1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and relays provided under this section.

2. Furnish two (2) instruction manuals covering function and operation of control systems for use of the Owner's operating personnel. A competent technician shall be provided for instruction purposes.

3. Provide training in the setting, use and care of the ATC systems. Training shall commence after the Owner has taken possession of the building and shall not exceed three (3) hours. Cost of additional training shall be negotiated between the Owner and ATC Contractor.

G. Guarantee

Control system shall be guaranteed to be free from original defects in both material and workmanship for a period of not less than one (1) year of normal use and service. This guarantee shall become effective starting the date Architect agrees Owner has begun to receive beneficial use of the system.

H. Hazardous Materials

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the ATC system.

I. Control Panels

1. Provide and install surface mounted control panel with dust tight gasketed, hinged door with enamel finish in Mechanical Room where indicated on the drawings. All switches, relays and equipment necessary for system operation shall be provided in control panel including the following:

a. Separate thermometers indicating outdoor air and re-set water temperature (on face of panel).
b. Pump selector switches (on face of panel) where applicable.
c. Install engraved plastic identifying tags for each switch on unit.

2. All electric wiring within the panel shall be factory wired to terminal strips.

J. Thermostats

1. General

All thermostats shall be mounted as required by ADA standards but not higher than 48 inches above finish floor to top.

2. Apartments and common areas.

a. Direct Radiation: Thermostats shall be low voltage, digital, single temperature, with large backlit L.E.D. temperature display.
b. Thermostats shall not contain mercury or any other toxic material.
c. Honeywell T8775A1005 for heating only or approved equal.
d. Provide clear, tamperproof covers in corridors and common areas

3. Public areas– same as apartments and common areas but with clear, tamperproof cover.

4. Fan thermostats

Heavy duty, line voltage, all metal type. Reverse acting (cooling).

5. Cabinet unit heaters

a. These thermostats shall be of the single temperature type intended for use in visible areas.
b. Heavy duty with concealed adjustment and heavy duty clear plastic tamper proof covers.

K. Automatic Control Valves

All automatic control valves for direct radiation shall be two position. Valves shall be quiet in operation and fail safe in the normally open position in the event of control power failure. All control valves shall be line size and guaranteed to meet the heating loads as specified. All control valves shall be suitable for the pressure conditions and shall close against the differential pressure involved. Valve operators shall be low voltage. Body pressure rating and connection type (screwed or sweat) shall conform to pipe schedule in this specification.

L. Miscellaneous Devices

Provide all the necessary relays, transformers, valves, positioners, switches, etc. to make a complete and operable system.

M. Dampers

1. Control dampers shall have 16 gauge galvanized frames not less than 2 inches in width with airfoil blades not less than 14 gauge galvanized steel, and shall be adequately braced to form a rigid assembly. No dampers shall have blades more than 6 inches wide. Dampers shall be painted with one coat of lacquer. Dampers shall be two position or proportioning as required by specific application, opposed blade type with linkage concealed within the frame. Oilite bronze bearings shall be

provided at the ends of damper blades. ALL DAMPERS SHALL BE MOUNTED WITH BLADES ORIENTED HORIZONTALLY.

2. Damper operators shall be provided with bracket arrangement for location outside of air stream wherever possible. All damper motors shall be sufficient size to operate dampers, including slow opening and fast closing.

3. Dampers shall be provided with flexible metal edge and jamb seals and neoprene blade edge seals for tight closure. Leakage shall be certified to be no more than 2.0 CFM per square foot at 1 inch w.g. on units 24 inches wide and larger, 3.0 CFM per square foot at 1 inch w.g. on units less than 24 inches wide.

4. Control dampers furnished by the Automatic Temperature Control Contractor shall include motor operated dampers installed in supply fan 1 and 2 ducts. Dampers at all combination wall louvers shall be furnished by manufacturer of louver equipment involved.

5. Dampers shall be Ruskin Model CD60 or approved equal by Air Balance or Arrow.

N. Description of Operation

1. System shall be hot water with water supplied from the boilers at a maximum of 180^{o}F, with 40^{o}F drop through the heating system.

2. Reset Water Control

A control sequence and hardware to maintain the water temperature to the system by modulating (resetting) boiler output temperature shall be provided within each boiler's own controls. ATC Contractor shall adjust the reset schedule to provide 180^{o}F water @ 20^{o}F outdoors to 130^{o}F water @ 65^{o}F outdoors (and higher). As the outside temperature falls, the supply water temperature shall be decreased. On a rise in outdoor air temperature, the temperature of the water shall be decreased.

Additional control shall be provided to give priority to domestic hot water. Whenever pumps P-4, P-5 or P-6 activate, the reset water controller shall increase boiler output temperature to 180^{o}F water for as long as required.

Coordinate with boiler manufacturer's literature for required control components and sequences not provided with boilers.

3. Boiler Controls

a. A true run time lead-lag control is specified to be supplied with the boiler controls.
b. ATC Contractor shall provide interlock wiring between boiler controls and pump P-1.
c. ATC Contractor shall provide interlock wiring between boiler controls and pumps P-3, P-4 and P-5 for domestic hot water override control.
d. Coordinate with boiler manufacturer for required control components (if any) and sequences not provided with boilers.
e. Boiler manufacturer is required to provide qualified personnel to install

boiler related controls and wiring requiring field installation. Installer is required to work closely with the ATC Contractor to be sure interlocks between boiler controls and building controls are installed and functioning properly. See par. 2.11, “BOILERS”.

4. Control of Circulating pumps

   a. Heating Pumps (P-1 and P-2): Pumps shall be provided from the factory with lead/lag controls and outdoor air controls. Provide and install communication wiring between each pump’s controller. Work with commissioning agent to program pumps for lead/lag operation and pump on/off operation based on outdoor air temperature. Active pump shall run continuously when outdoor temperature is below 62^{o}F. and off above 65^{o}F. (adjustable).
   b. Domestic Hot Water Pumps (P-4, P-5 and P-6): Each domestic hot water storage heater is provided with it’s own pump to supply boiler water to the heat exchanger coil. Each pump shall be controlled by an immersion aquastat (adjustable setpoints) to be provided and installed into the tank by the ATC Contractor. Pumps shall have a high limit (off) of 140 deg. F. and a low limit (on) of 120 deg. F. Interlock each pump with boiler domestic hot water over-ride controls.

5. Occupied-Unoccupied Control

   There shall be no automatic occupied to unoccupied control.

6. Control Panel

   Provide a control panel where indicated in Mechanical Room. The panel shall contain temperature indicators showing outdoor air temperature, boiler discharge temperature and supply (reset) water temperature. Panel shall also contain controls for pumps as previously outlined. All relays and accessories to accomplish the specified sequence of control shall also be contained in the panel.

7. Direct radiation

   All direct radiation shall be controlled by single temperature thermostats and two position, line size zone valves. When a thermostat calls for heat the zone valve opens.

8. Cabinet Unit Heaters

   Units to be supplied with remote thermostats and aquastats on hot water supply to each unit furnished and installed by ATC Contractor. When thermostat calls for heat the zone valve will open and the fan shall start provided the supply water temperature is not less than 130^{o}F.

8. Fans shall operate as indicated on "FAN SCHEDULE" on sheet M3.01. Provide 120 volt motor operated dampers to open when fans cycle (where indicated); wiring by Division 16 unless noted otherwise.

   a. Fans tagged “EF” to operate from switches provided with the fans and

installed by Division 16. All fans shall be switched individually with the room lights. A 7 day timing controller by Div. 16, shall permit all fans to operate simultaneously for a set time interval.

Exception: See Par. “b” below for fan in Elevator Machine room.

b. EF-2 in Elevator Machine Room shall operate from heavy duty, 120 volt reverse acting cooling thermostats.

C, EF-3 mounted on the roof, for the corridors, shall be controlled by an average temperature of the corridor thermostats. Energize EF-3 when temperature is greater than 75 deg. (adjustable) average.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all work is complete to the point where this installation may properly commence.

2. Verify that Mechanical systems may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies

1. In the event of discrepancy, immediately notify Architect.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION OF PIPING AND EQUIPMENT

A. General

1. All piping shall be installed within building insulation.

2. Size and general arrangements as well as methods of connecting all piping, valves, and equipment shall be as indicated, or to meet requirements for complete installation.

3. All vertical pumps shall be supported independently of the piping system.

4. All piping shall be erected to provide for easy and noiseless passage of hot water under all working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size in the direction of flow. Tee fittings with reduction in the main direction of flow (run) are not acceptable.

5. All hot water mains shall be run level or pitch slightly upward so that no air pockets are formed in piping. Mains shall be set at elevations so runouts feeding heating equipment shall have no pockets where air can collect or automatic vents shall be provided.

6. Where preset balancing valves are used, it is critical that there not be two valves installed in series anywhere throughout the piping system.

7. Provide drains with hose threads and metal caps at all low points in the water piping system.

8. In erection of hot water piping care must be taken to make allowance for expansion and contraction; piping shall be anchored as necessary to control expansion.

9. Runouts to hot water radiation shall be size indicated on plans.

10. Install brass fittings at all points of dissimilar piping connections.

11. Install a sufficient number of unions or flanges to facilitate assembly and disassembly of piping and removal of equipment.

12. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.

12. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective materials from the job site.

13. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load carrying members without the approval of the Architect.

14. All risers and offsets shall be substantially supported.

15. Make all changes in pipe size with approved reducing fittings.

16. All low points in water piping shall be provided with an accessible plug tee or drain valve.

17. All high points in water piping shall be provided with an accessible automatic vent.

18. Maximum spacing of pipe hangers (for metallic piping) shall be as follows:

Pipe Size	Spacing
½", ¾" & 1"	6'-0"
1¼" & 1½"	8'-0"
2" & 3"	10'-0"

19. Whenever possible valves shall be installed with the operating stems in the upright position, however when conditions dictate it is acceptable to position valves 90^{o} to either side of vertical. Valves shall not be installed with the stems in the downward position.

20. Do not substitute one style of valve indicated on drawings for another unless authorized by the Architect. Example: If a gate valve is shown use ONLY a gate valve or if a ball valve is shown use ONLY a ball valve.

21. Mount in-line air separators 3 inches in size and larger independent of the piping system. Do not obstruct removal area of strainer with pipe hangers, equipment or other piping.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all plugs.

2. Make all joints in copper tube (water and drains) with 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations.

C. Fire Safety

Fire extinguishing equipment shall be kept within 25 feet of welding areas at all times. No flammable materials shall be placed within 25 feet of welding areas unless they are physically connected to the building structure. Contractor shall take additional measures when welding close to flammable structures to protect the wood from igniting.

D. Thermometers

1. Install thermometers where indicated on drawings and:

2. Install thermometer wells on supply and return branch piping at all duct hot water heating coils and two (2) thermometers with storage cases for the Owner’s use.

3. Install thermometers on hot water piping at each port of reset water valve.

E. PEX tubing

1. Install PEX tubing where indicated on drawings.

2. Tubing shall be supported from building structure only, not from other piping or equipment.

3. Do not support other piping or equipment from PEX tubing.

4. PEX tubing may be threaded through structure with the structure acting as support so long as support is not provided in lengths greater than 32 inches on center. Use protective sleeves or bushings where tubing passes through metal studs. Tubing shall not have sags or low points that would prevent thorough drainage of the system.

5. Support devices shall be a product of the PEX manufacturer. Support devices shall be screwed, not nailed, into wood. Do not attach to the underside of floor decks. It is acceptable to support PEX tubing to the side of steel bar joists with “zip” strip draw bands at 32 inch centers (maximum).

3.03 PIPING TEST AND ADJUST

A. During the installation, all hot water supply and return piping shall be tested with water to a pressure of not more than 125 psi and held for a period of not less than four (4) hours. Isolate cast iron boilers and any other piping or devices not designed for this pressure. Do not use compressed air on PEX tubing systems. Any leaks shall be repaired and another test applied to the piping. All piping shall be tested before it is insulated or otherwise concealed. Contractor shall be required to certify in writing that piping has been tested and conforms to these requirements.

B. Before operating the water system, all of the new piping shall be flushed out to remove oil and foreign materials. This shall be accomplished by circulating a solution of heavy duty detergent by use of Mechanical Contractor supplied pump.

C. After the installation is complete and ready for operation, the system shall be tested under normal operating conditions in the presence of the Architect and demonstrated that the system functions as designed.

D. It shall be demonstrated that all parts of heating system have a free and noiseless circulation of steam and water and that all parts are tight. It shall also be demonstrated that all units are functioning properly and that control system operates correctly.

E. Should any defects in operation develop during the test periods, the Mechanical Contractor will proceed to correct defects immediately. Additional tests will be conducted after correction.

3.04 INSTALLATION OF DUCTWORK AND EQUIPMENT

A. General

1. Size and general arrangements as well as methods of connecting all registers, grilles, duct coils and equipment shall be as indicated, or to meet requirements for complete installation.

2. Construction standards and sheet metal gauges shall be as outlined in the latest edition of the SMACNA HVAC Duct Construction Standards handbook for metal and flexible ducts unless specifically indicated otherwise.

3. See paragraph 2.18, “Sheetmetal”, sub-paragraph F., “Sealing of Ducts” for duct sealing.

4. Manual Dampers

a. Manual dampers may be shop-fabricated on units 5 inches in height and less. All dampers larger than 5 inches MUST be pre-fabricated as previously outlined in this specification.
b. All manual dampers located within 10 feet of a fan outlet shall have the blades oriented perpendicular to the fan shaft.
c. Provide duct access door as large as possible up to 12 inches x 12 inches at EACH manual damper larger than 5 inches.

B. Protection and Cleaning

1. All open ends of ductwork which is to be unattended for 4 hours or more shall be temporarily protected with plastic sheeting and duct tape (or similar method) to reduce the collection of construction dust and debris.

2. All openings in mechanical equipment (unit ventilators, cabinet unit heaters, fans, etc.) shall be covered with cardboard and thoroughly sealed to duct and contaminants with painters tape during the construction period unless work is actually being performed on the equipment.

3. Prior to testing and balancing and at the end of the construction, clean the interiors of all supply and return air ductwork before changing filters in air handling equipment. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

3.04 TESTING, ADJUSTING AND BALANCING (TAB)

A. General

1. TAB contractor shall be a subcontractor to the Mechanical Subcontractor.

2. TAB contractor shall perform functional performance test of all Division 15 equipment and entire ATC system for specified operation and control sequences.

3. The mechanical contractor shall startup all Division 15 equipment as required by the equipment specifications. Mechanical contractor shall verify that systems are complete and operable before TAB commencing work. Ensure the following conditions:

   a. Systems are started and operating in a safe and normal condition.
   b. Temperature control systems are installed complete and operable.
   c. Proper thermal overload protection is in place for electrical equipment.
   d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   e. Duct systems are clean of debris.
   f. Fans are rotating correctly.
   g. Fire and volume dampers are in place and open.
   h. Air coil fins are cleaned and combed.
   i. Access doors are closed and duct end caps are in place.
   j. Air outlets are installed and connected.
   k. Duct system leakage is minimized.
   l. Hydronic systems are flushed, filled, and vented.
   m. Pumps are rotating correctly.
   n. Mechanical equipment is thoroughly clean and free of debris.

4. TAB Contractor shall submit field reports to General Contractor and Architect. Report defects and deficiencies noted during performance of services which prevent system testing and balance.

5. TAB contractor shall submit all verification and functional performance checklists/results, signed by indicated personnel, organized by system and sub-system.

6. TAB contractor shall submit other reports described below.

B. Work Included

1. Test, adjust and balance all air and water systems, including components to conform to air and water flow rates shown on drawings.

2. Test complete automatic temperature control sequences for specified operations described under AUTOMATIC TEMPERATURE CONTROLS.

3. Complete and submit balance report in spreadsheet format. Report shall be submitted with information noted on one side of sheet only (i.e., backside of sheet shall be blank.).

4. Testing of air and water systems will be done by the same agency.

5. Mechanical Contractor SHALL PROVIDE copies of shop drawings indicating coil gpm's, air handling unit air volumes, etc. to the Testing and Balancing contractor at no cost to the contractor.

6. The Balancing Contractor shall carry an allowance of $250. which may be used, if directed by the Architect, to change motor drives and belts as job conditions require. The allowance or unused portion shall be returned to the Owner upon acceptance of the system.

7. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Quality of Compliance

1. Qualification: TAB Contractor must be independent test and balancing agency.

2. AABC Compliance: Comply with AABC Manual MN-1 "AABC National Standards" as applicable to mechanical and hydronic distribution systems and/or Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

3. Industry Standards: Comply with ASHRAE recommendations for measurements, instruments and testing and balancing.

4. Coordination: Work together with Automatic Temperature Control Contractor to adjust set points of various devices to balance system(s) and test ATC sequences of operation. Temperature Control Contractor shall be responsible for balancing return air, exhaust (relief) air and outdoor air dampers on Air Handling Units in order to achieve proper mixed air temperatures.

5. ASHRAE Guideline 1-1996, "The HVAC Commissioning Process".

D. Execution of TAB Work

1. TAB Contractor shall visit job site and determine that control devices, test devices and valves are correctly installed and ready for balancing.

2. Examine each air and hydronic distribution system to see that it is free from obstructions. Determine that all dampers, registers and valves are in a set or full open position; that moving equipment is lubricated, and that required filters are clean and functioning. Request that Installing Contractor perform any adjustments necessary for proper functioning of the system.

3. TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer, and have been checked for accuracy prior to start of testing, adjusting and balancing activity.

4. Verify that all equipment performs as specified. Adjust variable type drives, volume dampers, control dampers, balancing valves and control valves as required by TAB work.

5. Test pressure profile of systems by traverse as required.

6. Adjust each register and damper to handle and properly distribute design airflow within 5% of specified quantities. Mark all setpoints.

7. Adjust front and rear discharge louvers on each supply register to distribute air in an even pattern or as indicated on plans.

8. Set all adjustable balancing valves so that each is furnished with design fluid flow within 5% of the specified quantities. Mark all set points.

9. Take readings at pre-set balancing valves and record flow readings.

10. Adjust air discharge patterns of all supply air diffusers, registers and grilles for optimal air diffusion.

11. Document results of all testing on approved TAB report formats and submit 3 copies for approval and record within 15 days of completion of TAB work. Include a warranty period of 90 days, during which time the Architect/Engineer may request a re-check or re-adjustment of any part of the work. Reports shall be compiled on a spreadsheet such as Excel, Quattro-Pro, Lotus, etc. and shall clearly indicate the following *minimum* information:

    a. Air (Rated and Actual)

        1) System/unit name
        2) HP, BHP, voltage, amperage and fan rpm
        3) Static pressures; suction, discharge and total
        4) Total system flow rate

5) Individual terminal flow rates (Terminal readings must show location, make, model and size of register, grille or diffuser).
6) Filter status report

b. Water

1) Pump full flow and no-flow suction and discharge pressures.
2) Rated and actual amperage, voltage and total discharge head (TDH).
3) Calibrated balancing device readings will indicate location, size, setting, differential pressure and rated and actual gpm.

Reports to have a minimum of color or must be compatible with monochrome printers. Reports must be submitted to the Architect electronically in addition to hard copies.

E. Drawings

Drawings in CAD format may be made available to the TAB Contractor after the contract for this work is awarded. Contact the Engineer via telephone or at mechsyst@maine.rr.com and request the drawings, indicating CAD format required and a return e-mail address. Files will be compressed and will require WinZip to extract them (available at http://www.winzip.com).

F. Acceptable TAB Contractors (listed alphabetically)

1. Central Air Balance
2. Maine Air Balance
3. Tab-Tech International
4. Tekon-Technical Consultants
5. Yankee Balancing

3.05 CLOSING IN UNINSPECTED WORK

A. General

Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance

Should any work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been inspected completely and approved, make all repairs and replacements with materials necessary for approval by the Architect and at no additional cost to the Owner.

If it is not practical to uncover the uninspected work it may, at the Architect's discretion, be considered inadequate and credit given to the Owner for the work as if it were not done in satisfactory accordance with the terms of the contract documents.

3.06 TEMPORARY HEATING

A. Mechanical Contractor shall install the new heating system and related equipment as soon as those portions of the building are ready and the work can be performed.

B. Mechanical Contractor will be required to permanently connect as many units as possible for temporary heat.

C. At the conclusion of the temporary heating period, the complete system shall be thoroughly cleaned.

D. General Contractor will be required to assume full responsibility for the care and operation of the new equipment during its temporary use and to return the equipment to the Mechanical Contractor in perfect order, normal wear and tear excepted.

E. Water, fuel and electric power required to operate the heating system for temporary heat shall be provided by the General Contractor.

3.07 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the heating and ventilating installation, including the removal all labels and all traces of foreign substance. Prior to testing and balancing vacuum and clean inside of all convectors, finned radiators (spackle droppings), unit ventilators, heat recovery units, fans and cabinet unit heaters. Clean the interiors of ductwork (where accessible) as outlined in 3.03, “INSTALLATION OF DUCTWORK AND EQUIPMENT”; paragraph “B”, “Protection and Cleaning”.

3.08 INSTRUCTIONS

On completion of the job, the Mechanical Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. (Temperature control system instruction shall be in addition to this instruction period). The time of instruction shall be arranged with the Owner.

3.09 RECYCLING

Discarded materials shall be recycled whenever practical through metal salvage dealers (ductwork, piping, etc.), paper salvage (cardboard shipping containers, etc.), wood & plastic products, etc. The Mechanical Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, refrigerants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

3.10 HAZARDOUS MATERIALS

Mercury, asbestos or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the mechanical systems.

END OF SECTION 230000

SECTION 26 00 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying drawings, including work related to:
   1. Electrical site services.
   2. Conduit for telecommunications site services.
   3. Conduit for fire alarm site services.
   4. Electrical distribution including new circuit breaker panelboards, load centers, and associated feeders.
   5. Electrical branch circuits, including wiring and devices.
   6. Interior lighting including luminaires, lamps, wiring and controls.
   7. Exterior lighting including luminaires and wiring and controls.
   8. Conduit and boxes for fire alarm system wiring.
   9. Conduit and boxes for cable television system wiring.
   10. Conduit and boxes for voice/data network system wiring.
   11. Conduit and boxes for wiring for owner provided door entrance access control system.

B. Include any minor items of work necessary to provide a complete and fully operative electrical system.

C. The Contractor for this work is referred to Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 01. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 01 supersede and must be satisfied by the Contractor.

1.2 RELATED SECTIONS

A. 26 05 26 – Grounding and Bonding for Electrical Systems

B. 26 05 33 – Raceway and Boxes for Electrical Systems

C. 27 05 23 – Cable Television System

D. 27 15 00 – Voice/Data System

E. 28 13 00 – Door Entry Access Control System

F. 28 31 00 – Fire Alarm System

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. ANSI/NFPA 101 - Life Safety Code.

C. OSHA 1910 - Occupational Safety and Health Act.

D. ADA - Americans with Disabilities Act.

1.4 GENERAL REQUIREMENTS

A. Contractor shall read the entire specifications covering other branches of work. He is responsible for coordination of his work with work performed by other trades.

B. Consult all Contract drawings which may affect the location of any equipment or apparatus furnished under this work and make minor adjustments in location as necessary to secure coordination. Contractor shall consult architectural reflected ceiling plans for exact locations of ceiling mounted lighting fixtures. Contractor shall consult architectural interior elevations for mounting heights of wiring devices. Contractor shall consult architectural exterior elevations for mounting heights of wall mounted exterior lighting fixtures.

C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of work.

D. Contractor shall contact the Owner’s Representative immediately if he notices any discrepancies or omissions in either the drawings or the specifications, or if there are any questions regarding the meaning or intent thereof.

E. Submit all changes, other than minor adjustments, to the Architect for approval before proceeding with the work.

1.5 SUBMITTALS

A. Submit under provisions of the following and Division 01.

B. Submittal shall include complete Specifications, including type of materials, electrical characteristics, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted shall be complete and shall apply only to this specific project. All extraneous material shall be deleted or marked out. Items to be supplied shall be specifically indicated using a method that will be visible after photocopying.

C. Regardless of any information included in the submittal submitted for review, the requirements of the Drawings and Specifications shall not be superseded in any way by the review. Review by the Architect-Engineer does not relieve responsibility for submittal errors or from meeting the requirements of the Contract Documents.

D. It is intended that Submittal data be complete and accurate at the first submission. If the Submittal is returned marked "Resubmit" only one additional submission will be permitted.

E. Submit related Submittal at one time. SUBMIT ALL ITEMS IN A SPECIFICATION SECTION AT THE SAME TIME. Incomplete submittal will be held until a complete submittal is accumulated or may be rejected without further review and returned to the applicable parties. Include a copy of the Specification Paragraphs pertaining to the items submitted.

F. If proposed equipment deviates from the Specifications or Drawings, indicate in writing on Company letterhead those differences and provide sufficient data to justify acceptance. FAILURE TO INDICATE DEVIATIONS OR SUBSTITUTIONS IMPLIES FULL COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

G. The term "by others" or similar wording shall not be used on Submittal. Submittal shall state by whom related items of work are to be provided. Where not indicated, it is implied that the work or item is provided under this Section.

H. Shop Drawings: Provide shop drawings as required by the individual Specification Sections. Submit shop drawings indicating physical size and arrangement, (plans and elevations) construction details, provisions for conduits, access requirements for installation and maintenance, finishes, and materials used in fabrication for all equipment. Supplement shop drawings with wiring diagrams for all systems with wiring connections for multiple components.

I. Submittals shall be made as paper copies. Submittals transmitted only by electronic email shall not be accepted.

1.6 REGULATORY REQUIREMENTS

A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:
1. State Building Codes.
2. Specific Construction Safety Requirements, State Industrial Commission.
3. National Electrical Code - NFPA 70.
4. National Fire Code - NFPA 72.
5. Life Safety Code - NFPA 101.
6. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
7. ADA - Handicap Accessibility Requirements.
8. Maine State Elevator Code.
9. Central Maine Power Company Standards

B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes and ordinances, and they are thereby included in these specifications. All work shall comply with the 2008 edition of NFPA 70, The National Electrical Code. It shall be the Contractor’s responsibility to assure that electrical work is in full compliance with the NEC.

C. The Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

D. Obtain and pay for all necessary permits. Request inspections from authority having jurisdiction.

1.7 RECORD DRAWINGS

A. Record any changes in location of concealed boxes, equipment items, receptacle and device outlets, lighting fixtures, fire alarm devices, underground utility service conduits, and similar construction items on a set of prints and deliver them to the Owner’s Representative upon completion of the work.

B. Record location and depth of exterior work carefully for future reference.

1.8 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide a Complete Instruction and Maintenance Manual: Prepare in the form of an instructional manual for use by Owner's personnel. Provide one (1) draft copy and two (2) final copies.
   1. Format:
      a. Size: 8-1/2" x 11", 20 lb. minimum weight white paper for typed pages, either manufacturer's printed data, or neatly typewritten.
      b. Drawings: Provide reinforced punched binder tab, bind in with text. Fold larger drawings to size of text pages. Clear plastic "binding tape" (not "Scotch" tape) applied to edge of sheet and then punched is acceptable.
      c. Single-sheet product literature and contractor-prepared pages: Provide reinforced punched binder tab. Clear plastic "binding tape" (not "Scotch" tape) applied to edge of page and then punched is acceptable.
      d. Provide indexed tabs and flyleaf for each separate product, or each piece of operating equipment. Include typed description of product, and major component parts of equipment.
      e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
      f. Binders:
         1) Commercial quality three-ring binders with durable and cleanable plastic covers, 1" minimum, 2" maximum ring size.
         2) When multiple binders are used, collate the data into related consistent groupings and provide a spine label that includes the volume number and contents of the binder.

B. Provide content as listed in separate Sections of Division 26 of these specifications.

1.9 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.10 COORDINATION WITH WORK PROVIDED UNDER DIVISIONS 22 AND 23

A. Electrical work for mechanical systems equipment furnished under Divisions 22 and 23 shall be coordinated with these respective Divisions.

B. Power wiring and connections shall be provided under Division 26 for all Division 22 and 23 equipment, including:
   1. Branch circuit power wiring.
   2. Local disconnect switches for 208-volt single and three phase equipment items (except where an integral means of disconnect is specified to supplied with the equipment item by the manufacturer).
   3. Motor starters for 208-volt single and three phase equipment items (except where an integral starter is specified to supplied with the equipment item by the manufacturer or where a variable speed drive is provided under Division 23).
   4. SPST Manual motor starter switch for 120-volt motors.

C. Work provided under Divisions 22 and 23 shall include:
   1. Motors.
   2. Motor speed controller switches.
   3. Low-voltage automatic temperature controls and associated wiring.
   4. Variable speed drives for motors.

D. In general, motors will be furnished and installed under other Divisions of work as a factory-installed item. Unless they are factory installed on equipment units supplied under other Divisions, all safety switches and motor starters shall be furnished and installed by the Electrical Contractor. Coordinate prior to submission of bid.
   1. Electrical Contractor shall obtain all wiring diagrams necessary to connect and control equipment requiring electrical energy.

E. Provide connections to Toiler Room exhaust fans and fan time switches. Local room fan/control light switches will be furnished under Division 23 and installed under Division 26.

1.11 COORDINATION WITH WORK PROVIDED UNDER OTHER DIVISIONS

A. Division 14 - Elevator: Provide all necessary connections to the elevator as required by the elevator supplier/installer. All work shall conform to the State Elevator Code. Provide all necessary components and wiring connections for full conformance with the Elevator Code. Verify equipment electrical characteristics with elevator submittals prior to rough-in of electrical wiring.

B. Division 27 - Cable Television:
   1. Provide conduit and boxes for cable television systems wiring as specified under Section 27 05 23.
   2. Provide underground conduit for cable television entrance from serving utility company.

C. Division 27 - Telecommunications:
   1. Provide conduit and boxes for voice/data systems wiring as specified under Section 27 15 00.
   2. Provide underground conduit for telephone service entrance from serving utility company.

D. Division 28 – Fire Alarm:

1. Provide 120-volt power requirements for the fire alarm equipment control panel.
2. Provide conduit and boxes for interior fire alarm system wiring as specified under Section 28 31 00.
3. Provide conduit for underground municipal fire alarm system.

E. Division 28 – Access Control:
1. Provide 120-volt power requirements for all door entry access equipment items.
2. Provide conduit and boxes for door entry access control systems wiring as specified under Section 28 13 00.

1.12 UTILITY SERVICE WORK

A. The Contractor shall arrange with *The Central Maine Power Company* to provide a new 120/208 volt, 3-phase, 4-wire service to the building. A new underground secondary service shall be extended from a utility pole with a pole-mounted service located across Crescent Street. The new underground secondary service shall be routed across Crescent Street to a service meter and a main circuit breaker to be located on the southeast corner of the building. A new service feeder shall be extended from the exterior main circuit breaker within the building, and shall enter the Ground Floor at the Mechanical Room G06, where it shall be connected to a service/distribution panelboard.
1. Work by *CMP*:
   a. Modifications as may be required to the existing utility pole line at Crescent Street.
   b. Provision of a new 3-phase, pole-mounted service transformer.
   c. Provision of a service meter.
2. Work Included Under This Contract:
   a. Provision of riser conduit at the *CMP* utility pole.
   b. Provision of underground service conduit between the utility service pole and the service meter installed on the building, and between the service meter and the exterior main circuit breaker, and between the main circuit breaker and the service/distribution panelboard in Mechanical Room G06.
   c. Provision of all secondary service wiring conductors.
   d. Provision of a service meter socket enclosure.
   e. Service grounding.

B. Telephone and Cable Television Services:
1. New underground telephone and cable television services shall be extended from the utility pole across Crescent Street. The services shall be routed across Crescent Street and shall extend into the building where they shall be routed to the Ground Floor Mechanical Room G06. Service demarcation equipment shall be installed on the exterior of the building.
2. Work Specified Under Division 27:
   a. Coordination of new services with *FairPoint* and *Time-Warner*.
   b. Telephone service cables within the building between the service entrance point and the service backboard in the Ground Floor Mechanical Room G06.
   c. Cable televison service cables within the building between the service entrance point and the service backboard in the Ground Floor Mechanical Room G06.
3. Work Included Under Division 26:
   a. Provisions of riser conduit at the utility service pole.

b. Provision of service conduit between the utility service pole and the service demarcation point on the exterior of the building, and between the demarcation point and the service backboard in the Ground Floor Mechanical Room G06.
c. Service backboard for telephone/cable television wiring equipment.

C. Municipal Fire Alarm Service:
1. A new underground municipal fire alarm service shall be extended from a utility pole across Crescent Street. The new underground fire alarm service shall be routed across Crescent Street to a municipal alarm box to be located on the southeast corner of the building. A new fire alarm communications cable shall be extended within the building to the Ground Floor at the Mechanical Room G06, where it shall be connected to the building's fire alarm control panel.
2. Work Specified Under Division 28:
a. Coordination of new services with the City of Portland Fire Department.
b. Provision of the fire alarm control panel.
c. Provision of the municipal fire alarm service cable.
3. Work Included Under Division 26:
a. Provisions of riser conduit at the utility service pole.
b. Provision of service conduit between the utility service pole and the municipal fire alarm box on the outside of the building, and between the municipal alarm box and the fire alarm control panel in the Mechanical Room G06.

1.13 UTILITY SERVICE CHARGE ALLOWANCE

A. The Contractor shall include under Division 26 an allowance of $25,000.00 to cover the cost of utility service charges. This allowance will be paid according to actual utility company invoices received.

1.14 FIRESTOPPING

A. Firestopping around electrical cable, conduit and/or boxes and firestopping within boxes shall be as specified under Section 26 05 33 to maintain fire ratings at walls, floors and ceilings. The Contractor shall coordinate penetrations of rated surfaces with the architectural drawings and specifications to assure that the proper fire rating is achieved.

1.14 TEMPORARY POWER AND LIGHTING

A. The Contractor shall be responsible for provision of temporary electrical power and lighting as required to facilitate construction work.
1. Temporary electrical power shall be obtained from the serving utility company. The Contractor shall make all necessary provisions for the connection of a temporary power service.
2. The Contractor shall provide temporary electrical power distribution as required to facilitate construction activities including:
a. Wire/conduit
b. Over-current protection
c. Receptacle outlets
d. Motor disconnect means

e. Grounding

3. The Contractor shall provide temporary lighting as required to facilitate construction activities.
4. All temporary electrical power and lighting shall be completely removed prior to substantial completion of the project.

1.15 SUBSTANTIAL AND FINAL COMPLETION

A. Refer to General Conditions and Supplementary Conditions.

B. Substantial Completion shall not be considered unless all systems are tested and verified for adherence with Contract Documents and any work remaining is less than one percent of the total Contract Value of this Section.
1. Record Drawings, Operation and Maintenance Manuals, Acceptance Demonstrations, Owner personnel training, spare parts or extra materials required, test reports, warranties and certifications of installation inspections shall be submitted and accepted prior to Substantial Completion.

C. Final Completion shall be when all work under this Section is completed as defined by the Contract Documents and accepted by the Architect-Engineer.

D. When Architect-Engineer determines Work is complete, close out submittals will be considered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish new and undeteriorated materials and of a quality not less than what is specified.

B. The selection of materials and equipment to be furnished shall be governed by the following:
1. Where single trade name, brand of manufacturer or material is listed in the specification, the exact equipment listed shall be used in the bid.
2. Where more than one name is listed, Contractor may select any one of the several brands specified.
3. Where trade name, brand of manufacturer of equipment or material is listed in the specification followed by the word “or approved equal,” the Contractor may substitute product of equal quality from another manufacturer for consideration by the Engineer.

C. Conduit shall be as specified under Section 26 05 33.

D. The demarcation service backboard for Division 27 wiring shall be 3/4” thick plywood by 4-foot high by 8-foot long. The backboard shall be painted black.

PART 3 - EXECUTION

3.1 PROTECTION AND CLEANING

A. Protect all electrical work and products against damage during construction and pay the cost of repair or replacement of electrical products made necessary by failure to provide suitable safeguards or protection.

B. After all work has been inspected and approved, thoroughly clean all equipment, provided under this work.

C. Repair all dents and scratches in factory prime or finish coated on all electrical equipment.

3.2 CUTTING AND PATCHING

A. Cut and patch as required to install new work. Patching shall match existing surfaces in kind and finish.

B. Obtain prior approval from the Engineer before cutting any structural members.

3.3 EXCAVATION COORDINATION

A. The Contractor shall contact *Dig Safe* at least three business days, but not more than 30 calendar days, in advance of any excavation work (1-888-DIGSAFE).

B. Install underground conduits according to Section 26 05 33.

END OF SECTION 26 00 00

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire and cable.

B. Metal clad cable.

C. Non-metallic sheathed cable.

D. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceway and Boxes for Electrical Systems

B. Section 26 05 53 - Identification.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.6 COORDINATION

A. Determine required separation between cable and other work.

B. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE AND CABLE

A. Manufacturers:
1. *Southwire.*
2. *General Cable.*
3. *Rome.*
4. Substitutions: Approved equal.

B. Description: Single Conductor insulated wire.
1. Conductor: Copper.
2. Insulation Voltage Rating: 600 volts.
3. Insulation Type: THHN or XHHW.
4. Insulation Color: Color of all service, feeder, branch, motor control, and signaling circuit conductors shall be green for grounding conductors, and white for neutrals The color of the ungrounded conductors in different voltage systems shall be as follows:
   a) 120/208 volt, 3-phase: Phase A - black
      Phase B – red
      Phase C - blue

2.2 METAL CLAD CABLE

A. Manufacturers
1. *General Cable.*
2. *Phelps Dodge Cable.*
3. *Triangle.*
4. Substitutions: Approved equal.

B. Description: ANSI/NFPA 70, Type MC.
1. Conductor: Copper only.
2. Insulation Voltage Rating: 600 volts.
3. Insulation Temperature Rating: 60 degrees C.
4. Insulation Material: Thermoplastic.
5. Armor material: Steel.
6. Armor Design: Interlocked metal tape.
7. Jacket: None.

2.3 NONMETALLIC SHEATHED-CABLE

A. Manufacturers
1. *Rome Cable*
2. *General Cable*
3. *Triangle*
4. *Southwire*
5. Substitutions: Or Approved Equal.

B. Description: ANSI/NFPA 70, Type NMC.

1. Conductor: Copper only.
2. Insulation Voltage rating: 600 volts.

2.4 WIRING CONNECTORS

A. Manufacturers
   1. *3M.*
   2. *Ideal.*
   3. *Thomas and Betts.*
   4. Substitutions: Approved equal.

B. Compression set or twist-on type with integral molded insulation and internal metallic compression ring or spiral screw-on connecting device.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

A. Concealed Interior Locations (wood studs): Non-metallic sheathed cable or Type MC cable.

B. Concealed Interior Locations (metal studs): Type MC cable.

C. Exposed Interior Locations (Mechanical Room G06): Building wire in conduit.

D. Service Entrance: Building wire in conduit.

E. Panelboard and Loadcenter Feeders: Type MC cable.

F. Exterior Locations: Building wire in conduit.

3.4 INSTALLATIONS

A. Install products in accordance with manufacturers' instructions.

B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.

C. Use stranded conductors for control circuits.

D. Use conductor not smaller than 12 AWG for interior power and lighting circuits. Use Conductor not smaller than 10 AWG for exterior lighting circuits.

E. Use conductor not smaller than 16 AWG for control circuits.

F. Use 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.

G. Pull all conductors into raceway at same time.

H. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

I. Protect exposed cable from damage.

J. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.

K. Use suitable cable fittings and connectors.

L. Neatly train and lace wiring inside boxes, equipment, and panelboards.

M. Clean connector surfaces before installing lugs and connectors.

N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

O. Use split bolt connectors for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

P. Use solderless pressure connectors with insulating covers for conductor splices and taps, 8 AWG and smaller.

Q. Use insulated spring wire connectors with plastic caps for conductor splices and taps, 10 AWG and smaller.

3.5 FIELD QUALITY CONTROL

A. Inspect wire and cable for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer’s recommended values.

C. Verify continuity of each branch circuit conductor.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power system grounding.

B. Electrical equipment and raceway grounding and bonding.

1.2 SYSTEM DESCRIPTION

A. Provide a service ground at the service entrance.

B. Connect load center feeder ground conductors to service ground at main service entrance.

C. Connect branch circuit equipment wires to ground bus at load centers.

D. Provide a dedicated ground for the telephone service.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Service Ground Conductor: Bare copper, stranded conductor.

B. Load Center Feeder Ground Conductor: Copper conductor.

C. Branch Circuit Ground Conductors: Insulated (green) copper conductor.

D. Ground Rods: 5/8-inch diameter, by 8-feet long, copper clad steel rods with bronze ground clamps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide service ground system in accordance with Article 250 of NFPA 70. Connect service-grounding equipment to made electrodes as well as to the cold water service entrance pipe.

B. Provide a separate grounding conductor in load center feeders and in all branch circuits provided under this contract. Terminate each end on a grounding lug, bus, or bushing.

C. Provide grounding for service utility pole in accordance with all applicable *Central Maine Power Company* requirements.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 10 ohms.

END OF SECTION 26 05 26

SECTION 26 05 29

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit, cable and equipment supports.

B. Fastening hardware.

1.2 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Support Channel: Galvanized or painted steel.

B. Hardware: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors and/or beam clamps.

C. Anchors and Fasteners:
1. Concrete Structural Elements: Use expansion anchors.
2. Steel Structural Elements: Use beam clamps.
3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Use expansion anchors.
6. Sheet Metal: Use sheet metal screws.
7. Wood Elements: Use wood screws.

D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

E. Do not use powder-actuated anchors.

F. Do not drill structural steel members.

G. Fabricate supports or trapeze hangers from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. Bridge studs to and bottom with horizontal members to support flush-mounted loadcenters in new stud walls.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAY & BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rigid metal conduit and fittings.

B. Electrical metallic tubing and fittings.

C. Flexible metal conduit and fittings.

D. Liquid-tight flexible metal conduit and fittings.

E. Fire stopping.

F. Wall and ceiling outlet boxes.

G. Pull and junction boxes.

1.2 RELATED SECTIONS

A. Section 26 05 19 – Low Voltage Electrical Power Conductors

B. Section 26 27 26 - Wiring Devices

C. Section 28 31 00 - Fire Alarm System.

1.3 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated.

C. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

D. NEMA TC-2 – Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

E. NEMA TC-3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

F. ANSI/NEMA OS 1 – Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

G. ANSI/NFPA 70 – National Electrical Code.

1.4 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations and mounting heights of outlet, pull, and junction boxes.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 SUBMITTALS

A. Submit under provisions of Division 1 and Section 26 00 00.

B. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Electrical boxes are shown in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Include installation within 10 feet of location shown.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

A. Rigid Steel Conduit: ANSI C80.1.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

2.2 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. EMT: ANSI C80.3. galvanized tubing.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type, or set-screw type.

2.3 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: steel.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

2.4 LIQUID-TIGHT FLEXIBLE CONDUIT AND FITTINGS

A. Conduit: Flexible metal conduit with PVC jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

2.5 PLASTIC CONDUIT AND FITTINGS

A. Conduit: NEMA TC-2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC-3.

2.6 CONDUIT SUPPORTS

A. Conduit Clamps, Straps, and Supports: Steel or malleable iron.

2.7 FIRE STOP

A. Fire stopping materials shall be NRTL listed to UL 1479 (ASTM E814). Installation methods shall conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials shall be as manufactured by *3M, International Protective Coatings Corp., Specified Technologies, Inc., Carborundum Company, RayChem, Nelson Fire Stop* or approved equal.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include ½ inch male fixture studs where required.

B. Cast Boxes: NEMA FB 1, Type FD. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Non-Metallic Outlet Boxes: PVC Type FS, UL listed.

D. Air-Seal Boxes
1. Outlet Boxes in Exterior Walls: Provide air-vapor barrier boxes for all outlets in exterior walls and demising walls. Boxes shall be as manufactured by *Lessco*, or approved equal.
2. Boxes at Top Floor Ceiling: Provide air-vapor barrier boxes for all outlets in ceilings at the top floor. Boxes shall be as manufactured by *Lessco*, or approved equal.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS1, galvanized steel.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Size conduit for conductor type installed, 3/4-inch minimum.

B. Arrange conduit to maintain headroom and present a neat appearance.

C. Route conduit parallel and perpendicular to walls and adjacent piping.

D. Maintain minimum 6-inch clearance between conduit and heat sources such as flues, steam pipes and heating appliances.

E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

H. Support conduit at a spacing not to exceed the spacing allowed per NFPA 70

3.2 CONDUIT INSTALLATION

A. Cut conduit square using a saw or a pipecutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.

D. Install no more than the equivalent of three 90-degree bends between boxes.

E. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum. Provide spacers for multiple runs of buried raceways.

F. Use conduit bodies to make sharp changes in direction, as around beams.

G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1-inch size.

H. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

I. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

J. Provide No. 12 AWG insulated conductor or suitable nylon pull rope in empty conduit, except sleeves and nipples.

K. Install expansion joints where conduit crosses building expansion joints.

L. Where conduit penetrates fire-rated walls and floors, seal opening around conduit with UL listed foamed silicone elastomer compound.

M. Route conduit through roof openings for piping and ductwork where possible; otherwise, route through roof jack with pitch pocket.

N. Where conduit(s) pass(es) from refrigerated or cooled atmosphere to warmer areas where condensation of water vapor may occur within raceways, conduit bodies sealed with “Duct Seal” type compound shall be provided after conductors are installed.

O. Flexible conduit shall not exceed three (3) feet in length.

3.3 UNDERGROUND CONDUIT INSTALLATION

A. Install top of conduit minimum 30 inches below finished grade.

B. Encase electrical service conduits in a 3-inch (minimum) concrete envelope where conduits cross Crescent Street. Extend concrete encasement 10-feet beyond edge of pavement.

C. Slope underground conduit away from building.

D. Use rigid galvanized steel conduit sweeps for underground elbows in conduit sizes 2-inches and larger.

3.4 CONDUIT INSTALLATION SCHEDULE

A. Exposed Outdoor Locations: Rigid steel conduit.

B. Concealed Interior Locations: Electrical metallic tubing.

C. Exposed Interior Locations (Mechanical Room G06 only): Electrical metallic tubing.

D. Interior Motor Connections: Flexible metal conduit.

E. Exterior Motor Connections: Liquid-tight flexible conduit.

F. Underground Installations: Schedule 40 plastic PVC conduit.

3.5 FIRE STOP INSTALLATION

A. Provide fire stop for all conduits and conduits and conduit sleeves that pass through fire-rated partitions, ceilings and/or floors.

3.6 BOX INSTALLATION

A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements.

F. Align adjacent wall-mounted outlet boxes for fire alarm devices, switches, receptacle outlets, door entry access stations, telecommunications outlets, thermostats, and similar devices with each other.

G. Use flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated or fire-rated walls. Where 24-inch separation in acoustic-rated or fire-rated walls is not physically possible, approval for closer spacing shall be obtained from the Architect prior to rough-in. In such cases, provide UL listed firestop pads for boxes.

I. Where two (2) or more single-gang boxes are to be installed side-by-side, mount boxes a stud-width apart.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Use stamped steel bridges to fasten flush mounting outlet box between studs.

L. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

M. Use adjustable steel channel fasteners for hung ceiling outlet box.

N. Do not fasten boxes to ceiling support wires.

O. Support boxes independently of conduit.

P. Use gang boxes where more than one device is mounted together. Do not use sectional box.

Q. Use gang box with plaster ring for single device outlets.

R. Use cast outlet box in exterior locations and wet locations.

S. Use either sheet metal or non-metallic outlet boxes with non-metallic sheathed cable. Use sheet metal outlet boxes with Type MC cable.

T. Provide UL-listed fire-stop material in boxes that are recessed into fire rated walls. Refer to Architectural Contract Drawing for identification of fire walls.

U. Install air-seal boxes in full conformance with the manufacturer's recommendations. Flanges shall be sealed to drywall or vapor barrier with caulking cable penetrations at air-seal boxes shall also be sealed.

3.6 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closure in unused box opening.

3.7 INTERFACE WITH OTHER PRODUCTS

A. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

B. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

END OF SECTION 26 05 33

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates and tape labels.

B. Panelboard Directories.

C. Underground marker tape.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Underground Warning Tape: 6” wide plastic tape, colored red with suitable legend describing buried electrical lines: Model UT27737 as manufactured by *Emedco*, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

D. Install underground warning tapes at all buried lines 6” below finished grade.

3.2 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates to identify all electrical disconnect switches, transformers, motor starters, and panelboard. Letter Height: ¼ inch. Use designations indicated on Single Line Diagram included in the Contract Drawings.

3.3 PANELBOARD DIRECTORIES

A. Provide a typed directory of panel circuit load descriptions for all panelboards. Mount directory to inside of panel cover.

END OF SECTION 26 05 53

SECTION 26 06 20.16

ELECTRICAL PANELBOARD SCHEDULE

SEE ATTACHED

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-A**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: STORAGE

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A		LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	5169			2	L	1169	LIGHTS	1	20
50	2	RANGE	4000	O	3			5400	4	R	1400	BEDROOM RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1700			6	R	1200	BEDROOM RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2700	8	R	1200	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	1900			10	R	400	BATHROOM RECEPT	1	20
20	1	KITCHEN RECEPTS	600	R	11			1800	12	R	1200	LIVING/DINING RECEPT	1	20
20	1	KITCHEN RECEPTS	800	R	13	2000			14	R	1200	BEDROOM RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	15			1400	16	R	1000	BEDROOM RECEPTS	1	20
20	1	LIVING RM RECEPTS	1200	R	17	2200			18	R	1000	BEDROOM RECEPTS	1	20
20	1	SPARE	500	S	19			900	20	R	400	BATHROOM RECEPT	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20
		PHASE TOTALS				13969		13200						

CONNECTED VOLT-AMPERES= 27169

CONNECTED AMPERES= 113

DEMAND VOLT-AMPERES= 14169

DEMAND AMPERES= 59

	CIRCUIT TYPE CODES	DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-B**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: STORAGE

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A	LOAD	LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	4843			2	L	843	LIGHTS	1	20
50	2	RANGE	4000	O	3			5200	4	R	1200	BEDROOM RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1700			6	R	1200	BEDROOM RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2700	8	R	1200	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	1900			10	R	400	BATHROOM RECEPT	1	20
20	1	KITCHEN RECEPTS	400	R	11			800	12	R	400	BATHROOM RECEPT	1	20
20	1	KITCHEN RECEPTS	600	R	13	1800			14	R	1200	DINING/HALL RECEPTS	1	20
20	1	SPARE	500	S	15			1700	16	R	1200	LIVING RECEPTS	1	20
20	1	SPARE	500	S	17	1000			18	S	500	SPARE	1	20
20	1	SPARE	500	S	19			1000	20	S	500	SPARE	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20
		PHASE TOTALS				12243		12400						

CONNECTED VOLT-AMPERES= 24643

CONNECTED AMPERES= 103

DEMAND VOLT-AMPERES= 12743

DEMAND AMPERES= 53

CIRCUIT TYPE CODES		DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-C**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: HALLWAY

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A		LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	4895			2	L	895	LIGHTS	1	20
50	2	RANGE	4000	O	3			5200	4	R	1200	BEDROOM RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1700			6	R	1200	BEDROOM RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2700	8	R	1200	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	2700			10	R	1200	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	11			1800	12	R	1200	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	800	R	13	1800			14	R	1000	LIVING/HALL RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	15			1400	16	R	1000	DINING RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	17	900			18	S	500	SPARE	1	20
20	1	SPARE	500	S	19			1000	20	S	500	SPARE	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20
		PHASE TOTALS				12995		13100						

CONNECTED VOLT-AMPERES= 26095

CONNECTED AMPERES= 109

DEMAND VOLT-AMPERES= 13495

DEMAND AMPERES= 56

CIRCUIT TYPE CODES		DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-D**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: HALLWAY

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A		LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	4799			2	L	799	LIGHTS	1	20
50	2	RANGE	4000	O	3			5000	4	R	1000	LIVING RM RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1500			6	R	1000	DINING/HALL RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2500	8	R	1000	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	2500			10	R	1000	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	11			1600	12	R	1000	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	13	1000			14	R	400	BATHROOM RECEPT	1	20
20	1	BATHROOM RECEPT	400	R	15			900	16	S	500	SPARE	1	20
20	1	SPARE	500	S	17	1000			18	S	500	SPARE	1	20
20	1	SPARE	500	S	19			1000	20	S	500	SPARE	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20
		PHASE TOTALS				11799		12000						

CONNECTED VOLT-AMPERES= 23799

CONNECTED AMPERES= 99

DEMAND VOLT-AMPERES= 12299

DEMAND AMPERES= 51

	CIRCUIT TYPE CODES	DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-E**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: HALLWAY

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A		LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	4929			2	L	929	LIGHTS	1	20
50	2	RANGE	4000	O	3			5000	4	R	1000	DINING RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1700			6	R	1200	LIVING RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2500	8	R	1000	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	2700			10	R	1200	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	11			1600	12	R	1000	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	800	R	13	2000			14	R	1200	BEDROOM RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	15			1600	16	R	1200	BEDROOM RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	17	900			18	S	500	SPARE	1	20
20	1	SPARE	500	S	19			1000	20	S	500	SPARE	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20

PHASE TOTALS 13229 12700

CONNECTED VOLT-AMPERES= 25929

CONNECTED AMPERES= 108

DEMAND VOLT-AMPERES= 13429

DEMAND AMPERES= 56

CIRCUIT TYPE CODES		DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-F**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: HALLWAY

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A	LOAD	LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	4929			2	L	929	LIGHTS	1	20
50	2	RANGE	4000	O	3			4800	4	R	800	DINING RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1700			6	R	1200	LIVING RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2500	8	R	1000	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	2700			10	R	1200	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	11			1600	12	R	1000	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	800	R	13	2000			14	R	1200	BEDROOM RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	15			1600	16	R	1200	BEDROOM RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	17	900			18	S	500	SPARE	1	20
20	1	SPARE	500	S	19			1000	20	S	500	SPARE	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20
		PHASE TOTALS				13229		12500						

CONNECTED VOLT-AMPERES= 25729

CONNECTED AMPERES= 107

DEMAND VOLT-AMPERES= 13329

DEMAND AMPERES= 56

CIRCUIT TYPE CODES		DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/240 AMPS 125 MAIN: MLO **PANEL: LC-G**

MOUNT: RECESSED PHASE: 1 WIRES: 3 LOCATION: HALLWAY

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A	LOAD	LOAD B	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
50	2	RANGE	4000	O	1	4708			2	L	708	LIGHTS	1	20
50	2	RANGE	4000	O	3			5200	4	R	1200	LIVING RECEPTS	1	20
20	1	RANGE HOOD	500	M	5	1500			6	R	1000	DINING RECEPTS	1	20
20	1	REFRIGERATOR	1500	O	7			2700	8	R	1200	BEDROOM RECEPTS	1	20
20	1	DISHWASHER	1500	O	9	2700			10	R	1200	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	11			1800	12	R	1200	BEDROOM RECEPTS	1	20
20	1	KITCHEN RECEPTS	600	R	13	1200			14	R	600	HALL RECEPTS	1	20
20	1	BATHROOM RECEPT	400	R	15			800	16	R	400	BATHROOM RECEPT	1	20
20	1	SPARE	500	S	17	1000			18	S	500	SPARE	1	20
20	1	SPARE	500	S	19			1000	20	S	500	SPARE	1	20
20	1	SPARE	500	S	21	1000			22	S	500	SPARE	1	20
20	1	SPARE	500	S	23			1000	24	S	500	SPARE	1	20
		PHASE TOTALS				12108		12500						

CONNECTED VOLT-AMPERES= 24608

CONNECTED AMPERES= 103

DEMAND VOLT-AMPERES= 12658

DEMAND AMPERES= 53

CIRCUIT TYPE CODES		DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/208 AMPS 225 MAIN: MLO **PANEL: HP SECTION 1**

MOUNT: SURFACE PHASE: 3 WIRES: 4 LOCATION: MECHANICAL G06

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A	LOAD B	LOAD C	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
30	2	DRYER	2500	O	1	3000			2	S	500	SPARE	1	20
30	2	DRYER	2500	O	3		3000		4	S	500	SPARE	1	20
30	2	DRYER	2500	O	5			2644	6	L	144	EXTERIOR LIGHTS	1	20
30	2	DRYER	2500	O	7	3424			8	L	924	STAIRWELL LIGHTS	1	20
30	2	DRYER	2500	O	9		3616		10	L	1116	LIGHTS	1	20
30	2	DRYER	2500	O	11			3700	12	R	1200	GROUND FL RECEPTACLES	1	20
20	1	WASHER	1500	O	13	2500			14	R	1000	GROUND FL RECEPTACLES	1	20
20	1	WASHER	1500	O	15		2000		16	O	500	TELEPHONE EQUIP	1	20
20	1	WASHER	1500	O	17			2000	18	O	500	FIRE ALARM PANEL	1	20
20	1	CARD MACHINE	500	O	19	1000			20	O	500	FIRE ALARM BOOSTERS	1	20
20	1	SECOND FL RECEPTACLES	800	R	21		1800		22	R	1000	FIRST FL RECEPTACLES	1	20
20	1	THIRD FL RECEPTACLES	800	R	23			1300	24	O	500	HANDICAP DOOR OPER	1	20
60	3	PANEL HP SECTION 2	4732		25	5232			26	O	500	SPARE	1	20
60	3	PANEL HP SECTION 2	6068		27		6568		28	S	500	SPARE	1	20
60	3	PANEL HP SECTION 2	5818		29			6318	30	S	500	SPARE	1	20
		PHASE TOTALS				15156	16984	15962						

CONNECTED VOLT-AMPERES= 48102

CONNECTED AMPERES= 134

DEMAND VOLT-AMPERES= 25518

DEMAND AMPERES= 71

	CIRCUIT TYPE CODES	DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

VOLTS: 120/208 AMPS 100 MAIN: MLO **PANEL: HP SECTION 2**

MOUNT: SURFACE PHASE: 3 WIRES: 4 LOCATION: MECHANICAL G06

BREAKER A	BREAKER P	DESCRIPTION	CKT VA	TYPE	CKT NO.	LOAD A	LOAD B	LOAD C	CKT NO.	TYPE	CKT VA	DESCRIPTION	BREAKER P	BREAKER A
20	1	EF-2	96	M	31	296			32	M	200	FC-1 ALT #1	1	20
20	1	B-1	1200	M	33		1950		34	H	750	CUH-1 THRU CUH-5	1	20
20	1	B-2	1200	M	35			1918	36	M	718	P-2	2	20
20	2	P-1	718	M	37	1436			38	M	718	P-2	2	20
20	2	P-1	718	M	39		1218		40	M	500	P-5	1	20
20	1	P-3	500	M	41			900	42	R	400	ELEVATOR PIT RECEPT	1	20
20	1	P-4	500	M	43	1000			44	O	500	ELEVATOR CONTROLS	1	20
20	1	DOOR ENTRY	500	O	45		900		46	R	400	ELEV MACH RM RECEPT	1	20
20	1	SPARE	500	S	47			1000	48	O	500	CABLE TV EQUIPMENT	1	20
20	1	SPARE	500	S	49	1000			50	S	500	SPARE	1	20
20	1	SPARE	500	S	51		1000		52	S	500	SPARE	1	20
20	1	SPARE	500	S	53			1000	54	S	500	SPARE	1	20
20	1	SPARE	500	S	55	1000			56	S	500	SPARE	1	20
20	1	SPARE	500	S	57		1000		58	S	500	SPARE	1	20
20	1	SPARE	500	S	59			1000	60	S	500	SPARE	1	20
		PHASE TOTALS				4732	6068	5818						

CONNECTED VOLT-AMPERES= 16618

CONNECTED AMPERES= 46

DEMAND VOLT-AMPERES= 8684

DEMAND AMPERES= 24

	CIRCUIT TYPE CODES	DEMAND FACTOR
L	LIGHTS	1.0
M	MOTORS	0.5
R	RECEPTACLES	0.5
H	HEAT	1.0
O	OTHER	0.5
S	SPARE	0.5

PROJECT: **CRESCENT HEIGHTS**

PROJ. NO: 08-0047

DATE: 03/17/09

STATUS: FOR CONSTRUCTION

Bartlett Design

LIGHTING & ELECTRICAL ENGINEERING

942 WASHINGTON STREET BATH, MAINE 04530

TEL (207) 443-5447 FAX (207) 443-5560

SECTION 26 06 50.16

LIGHTING FIXTURE SCHEDULE

SEE ATTACHED

Bartlett Design
942 Washington Street, Bath, ME
(T) 207-443-5447 (F) 207-443-5560

LIGHTING FIXTURE SCHEDULE

Lamp numbers refer to Osram Sylvania designations. Also approved are equal lamps manufactured by General Electric, and Philips. All fixtures are 120 volt, unless specifically noted otherwise.
NOTE: All fluorescent ballasts shall be low harmonic type (≤ 10%).

Dimensions: Diameter = 14 5/8" Depth = 4 1/2"

Type: **C1**
Description: Surface ceiling mount luminaire with white satin glass diffuser and satin nickel trim. Provide electronic non-dimming ballast.
Lamps: (2) CF26DD/E/835
Manufacturers: *Estiluz* # T-2124F-37

Dimensions: Length/Width = 16 1/8" Depth = 4 3/8"

Type: **C2**
Description: Surface ceiling mount luminaire with white satin glass diffuser. Luminaire shall have satin nickel trim finish. Provide electronic non-dimming ballast.
Lamps: (2) CF26DD/E/835
Manufacturers: *Estiluz* # T-9249-37

Dimensions: Diameter = 11 1/2" Depth = 3 1/2"

Type: **C3**
Description: Surface ceiling mount luminaire with white opal glass diffuser. Luminaire shall have satin nickel trim finish. Provide electronic non-dimming ballast.
Lamps: (2) CF13DD/E/835
Manufacturers: *Forecast Lighting* # F6140-36E1

Dimensions: Diameter = 16" Depth = 4"

Type: **C4**
Description: Surface ceiling mount luminaire with white acrylic diffuser and perforated metal sides. Luminaire shall have satin nickel trim finish. Provide electronic non-dimming ballast.
Lamps: (2) CF26DD/E/835
Manufacturers: *Forecast Lighting* # F2080-36U

Dimensions: **Diameter = 11” Depth = 3 7/8”**

Type: **C5**
Description: Small profile surface ceiling luminaire with white acrylic diffuser. Provide electronic non-dimming ballast.
Lamps: (2) CF13DD/E/835
Manufacturers: *Lightolier* #6750WH213U

Dimensions: **Length = 16.5” Height = 5.5” Projection = 7.8”**

Type: **E1**
Description: 12 Volt, self-contained emergency light with two lamps (minimum 7.2 watts each) and integral battery rated to operate fixture for 90 minutes upon loss of normal power.
Lamps: (2) By Manufacturer
Manufacturers: *Lightolier* #E2 2 50N H20 W

Dimensions: **Width = 5 1/2” Height = 4 1/4” Length = 48”**

Type: **J1**
Description: Surface mounted luminaire with virgin prismatic acrylic lens. Luminaire finish shall be white. Provide electronic non-dimming ballast.
Lamps: (1) F028/835/XP/SS/ECO
Manufacturers: *Lightolier* # JS4C132120HI

Dimensions: **Width = 12” Height = 6 1/2” Length = 52”**

Type: **J2**
Description: Surface mounted 1x4 luminaire with white acrylic diffuser lens. Luminaire finish shall be white. Provide electronic non-dimming ballast.
Lamps: (2) F028/835/XP/SS/ECO
Manufacturers: *Forecast Lighting* # F2513-L80E8U

Dimensions: **Width = 5.22” Height = 10.69” Projection = 2”**

Type: **L1**
Description: Thin profile surface wall luminaire. Where installed in closets, mount luminaire immediately above door inside closet. Where installed at elevator pit, mount luminaire 18” above pit floor.
Lamps: (1) CF13DS/835/ECO
Manufacturers: *Lightolier* #6580

Dimensions: **Luminaire Height = 2 15/16”** **Width = 4 3/16”**

Type: **R1**
Description: Decorative pendant hung luminaire with etched glass diffuser encased around transparent blue glass diffuser. Luminaire finish shall be white. Suspend luminaire with conduit to a height of 6’ – 6” AFF.
Lamps: (1) 35T4Q/CL/AX
Manufacturers: *Lightolier* # 86130AL/8687BL

Type: **S1**
Description: Existing lighting pole to remain.

Dimensions: **Width = 11 3/4”** **Height = 9 1/2”** **Projection = 8 1/4”**

Type: **S2**
Description: Cut-off surface wall fixture with full front face shield and tempered flat glass lens. Luminaire shall be UL listed for wet locations. Luminaire shall have black finish.
Lamps: (1) CF32DT/E/830
Manufacturers: *Exceline* # 61332HFL-1-BLACK

Dimensions: **Width = 6 11/16”** **Height = 36”**

Type: **S3**
Description: Exterior bollard with low-copper die-cast aluminum alloy housing. Luminaire shall have die-cast aluminum louvers with tempered ribbed glass globe. Provide electronic ballast. Luminaire finish shall be black. Luminaire shall be UL listed for wet locations.
Lamps: (1) CF32DT/E/830
Manufacturers: *Hadco* # RL72 A A0 32F E

Dimensions: **Diameter = 8 5/8”** **Recessed Height = 6 1/2”**

Type: **S4**
Description: Exterior recessed downlight with regressed prismatic acrylic lens. Provide electronic ballast. Luminaire shall be UL listed for wet locations.
Lamps: (1) CF32DT/E/830
Manufacturers: *Lightolier* # 8097PCLP/S7132BU

Dimensions: **Length = 22 3/4”** **Width = 5”** **Depth = 1 1/8”**

Type: **U1**
Description: Surface under cabinet task light luminaire with acrylic linear prismatic lens. Luminaire shall have white finish. Provide electronic non-dimming ballast.
Lamps: (1) FP14/835/ECO
Manufacturers: *Lightolier* # TSF114WUNVPG

Dimensions: **Height= 10”** **Width = 8”** **Depth = 4”**

Type: **W1**
Description: Surface wall mount luminaire with etched white opal glass diffuser. Luminaire shall have satin nickel trim finish. Provide electronic non-dimming ballast.
Lamps: (2) CF13DD/E/835
Manufacturers: *Forecast Lighting* # F5443-36E1

Dimensions: **Height= 16”** **Width = 6 1/2”** **Depth = 4”**

Type: **W2**
Description: Surface wall mount luminaire with ivory fabric lamp shade. Luminaire finish shall be satin nickel. Provide electronic non-dimming ballast.
Lamps: (1) CF26DD/E/835
Manufacturers: *Forecast Lighting* # F5482-36U/F5484

Dimensions: **Length = 24 1/2"** **Height= 4 5/8””** **Depth = 4 5/8”**

Type: **W3**
Description: Surface wall mount vanity light with wraparound white acrylic diffuser. Luminaire shall have white finish. Provide electronic non-dimming ballast.
Lamps: (1) F017/835/ECO
Manufacturers: *Lightolier* # 5491WHU

Dimensions: **Width = 12.13”** **Height = 8.63”** **Projection = 1.75”**

Type: **X1**
Description: Single face die-cast exit sign with red letters and integral battery supply rated to operate fixture for 90 minutes upon loss of normal power. Mount at height immediately above door frame. Provide directional arrows as indicated on plans.
Lamps: LED - By Manufacturer
Manufacturers: *Lightolier* #LL N U R W

SECTION 26 09 23

LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section of the specification includes the furnishing, installation, connection and testing of a complete lighting control system for both interior and exterior lighting. Provide all equipment required to form a complete, operative, and coordinated system as shown on the drawings and specified herein. Components of the Lighting Control System shall include, but are not limited to, the following:
   1. Lighting Time Switch.
   2. Occupancy Sensors.
   3. Exterior Photocell.

1.2 RELATED SECTIONS

A. Section 26 00 00 - Electrical General Requirements.

B. Section 26 05 19 – Low Voltage Electrical Power Conductors

C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.3 QUALITY ASSURANCE

A. All system materials shall be UL-listed for their intended duty.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 and Section 26 00 00.

B. Shop Drawings and Product Data:
   1. Submit complete and at one time. Provide manufacturer's catalog information showing dimensions, colors, and configurations. Isolated items will not be considered for approval, except by prior authorization.
   2. A technical data sheet from the manufacturer should be included with the response for each product proposed. This data sheet shall include the physical specifications as well as the electrical characteristic.
   3. The following is required for approval, prior to fabrication and installation:
      a. Catalog Data Sheets of all manufactured items, including manufacturer and model number.
      b. Wiring diagrams indicating proposed connections of all equipment and indicating equipment types and model numbers.

1.5 TRAINING

A. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of all systems and equipment.

1.6 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 26 00 00.

B. Accurately record location of all equipment items.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 26 00 00.

B. Include operating instructions, maintenance and repair procedures.

PART 2 – MATERIALS

2.1 EXTERIOR LIGHTING TIME SWITCH

A. Manufacturers:
1. *Tork* model DZS400A, or approved equal

B. Description: Four-channel, 365-day digital time switch with astronomic control. Switch shall include LCD display screen and shall be capable of 99 set points with separately scheduling for each day of the week. Controller shall have 365-day holiday capabilities with 24 single dates and four seasons of unlimited duration. Different daily schedules shall be programmable within each season. Controller shall include provisions for both daylight saving and standard times and shall have automatic leap year correction. Schedules shall be retained for 40 years without power. Controller shall have 30-day backup with replaceable 9-volt lithium battery.
1. Input Voltage: 120 VAC
2. Output Channel Ratings: 120 volt, 208-240 volt, 277 volt
3. Contacts: SPDT
4. Enclosure: NEMA Type 3, surface mounted with cover.

2.2 PHOTOCELL CONTROL

A. Manufacturers:
1. *Tork* model 2001
2. Substitutions: Or Approved Equal.

B. Description: Weatherproof adjustable SPST photocell with Lexan dome. Provide wall mount clip.
1. Voltage: 120V

2. Load Rating: 200 watts
3. Illuminance Range: ON: 1-5 footcandles, OFF: 3-15 footcandles

2.3 OCCUPANCY SENSORS

A. Manufacturers:
1. *Hubbell Building Automation*
2. *SensorSwitch*
3. *Leviton*
4. Substitutions: None Permitted.

B. Occupancy sensors to control lighting shall be as follows:
1. Corridor and Stairway Sensors: *Hubbell* Model LODT, or approved equal. Wall mounted, dual-technology, passive infrared and ultrasonic motion sensor with coverage pattern extending up to 40 feet. Sensor shall have time delay adjustment from 8 to 30 minutes and shall be provided with wall mounting bracket.
2. Rooms Sensors: *Hubbell* Model OMN11R, or approved equal. Ceiling mounted, passive infrared motion sensor with 360 degree coverage pattern extending up to 22 feet. Sensor shall have time delay adjustment from 8 to 30 minutes.

C. Occupancy Sensor Power Packs: Provide a 120 VAC:24 VDC power pack for each motion sensor. Power pack shall be *Hubbell* Model UVPPM, or approved equal.

PART 3 – EXECUTION

3.1 GENERAL

A. Do not install equipment and materials that have not been reviewed by the Architect-Engineer. Equipment and materials that are installed without the Architect-Engineer's review or without complying to comments issued with the review shall be removed from the project when so instructed by the Architect-Engineer. No payment will be made for unapproved or removal if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.

B. Obtain detailed information on installation requirements from the manufacturers of all equipment to be furnished, installed or provided. At the start of construction check all Contract Documents, including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.

C. Equipment and systems shall not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.

D. Any and all material installed or work performed in violation of above requirements shall be re-adjusted and corrected by the Installer without charge.

E. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical boxes, conduit and equipment, to determine the exact location of all outlets.

F. After installation, equipment shall be protected to prevent damage during the construction

period. Openings in conduits and boxes shall be closed to prevent the entrance of foreign materials.

G. Install all systems in strict accordance with the manufacturer's instructions.

3.2 WORK

A. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section shall be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.

B. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.

C. Clean and touch up all equipment, materials and work sites at the completion of work in each area.

3.3 TERMINATIONS

A. All conductors of every cable shall be completely terminated at both ends.

3.4 SYSTEM INSTALLATION

A. Provide all equipment and cabling for a complete installed operating system.

B. Cabling shall be installed concealed and shall be supported from the building structure.

C. All cables shall be installed in a neat and workman-like manner. Cables shall be installed parallel and perpendicular to building elements.

3.5 SYSTEM TESTING

A. Upon completion of the lighting control system, all components shall be tested to confirm their operation according to specification requirements and manufacturer's instructions.

3.6 CLEANING UP

A. Upon completion of all work, and testing, thoroughly inspect all exposed portions of the installation and completely remove all exposed labels, markings, and foreign material.

B. The interior of all boxes and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.

C. Repair damage to finish surfaces resulting from work under this Section.

D. Remove material and equipment from areas of work and storage areas.

E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.

END OF SECTION 26 09 23

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Residential Load Centers.

B. Panelboards.

1.2 REFERENCES

A. NECA (National Electrical Contractors Association) “Standard of Installation.”

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA PB 1 - Panelboards.

D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 Volts or Less.

E. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment.

F. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 26 00 00.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

1.4 SPARE PARTS

A. Keys: Furnish three sets to Owner.

PART 2 - PRODUCTS

2.1 LOAD CENTERS

A. Manufacturers:
1. *Square D.*
2. *General Electric.*
3. *Siemens.*
4. Substitutions: Or Approved Equal.

B. Load Centers: NEMA PB 1; circuit breaker type. UL listed for service entrance duty.

C. Enclosure: Recessed, NEMA PB 1; Type 1.

D. Cabinet Size: 3¾ inches deep; 14¼ inches wide.

E. Provide cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

F. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.

G. Minimum Integrated Short Circuit Rating: 22,000 amperes RMS symmetrical for 240-volt panelboards.

H. Molded Case Circuit Breakers: NEMA AB 1; plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles.

I. Arc-Fault Circuit Breakers: Provide arc-fault circuit breakers for all load center branch circuits supplying outlets in family rooms, dining rooms, living rooms, bedrooms, closets, hallways, and other similar rooms.

2.2 PANELBOARDS

A. Acceptable Manufacturers.
1. *Square D.*
2. *Cutler-Hammer.*
3. *General Electric*
4. *Siemens.*
5. Substitutions: None Permitted.

B. Circuit Breaker Panelboards
9. Panelboards: NEMA PB1; circuit breaker type.
10. Enclosure: NEMA PB 1; Type 1.
11. Branch Circuit Panelboard Cabinet Size: 5 ¾ inches deep; 20 inches wide.
12. Distribution Panelboard Cabinet Size: 8¼ inches deep; 32 inches wide.
13. Provide cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer’s standard gray enamel
14. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
15. Minimum Integrated Short Circuit Rating: 25,000 AIC for 208 volt panelboards.
16. Molded Case Circuit Breakers: NEMA AB 1; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits.
17. Provide circuit breaker accessory trip units and auxiliary contacts as indicated.

2.3 TRANSIENT PROTECTION

A. Acceptable Manufacturers:
1. *Current Technology* Model TG60-120/208-3GY
2. Substitutions: Or Approved Equal.

B. Provide transient protection unit for Panel HP-1 only.

1. Protection modes: L-N, L-G, N-G, L-L.
2. Single pulse serve current capacity: 60, 000 amperes (L-N, L-G, N-G, L-L); 120, 000 amperes (per phase).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install load centers and panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1. Install recessed, flush with wall finishes.

B. Height: 4 feet to top circuit breaker in load centers in residential units; 6 feet to top of house panelboard.

C. Provide filler plates for unused spaces in load centers and panelboards.

D. Provide typed circuit directory for each branch circuit panelboard and load center.

E. Install transient protection unit above Panel HP-1 in compliance with manufacturer's requirements and recommendations.

3.2 FIELD QUALITY CONTROL

A. Measure state load currents at each new panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Device plates.

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

1.4 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 26 00 00.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
   1. *Hubbell.*
   2. *Leviton.*
   3. *Bryant.*
   4. *Pass & Seymour*
   5. Substitutions: Or Approved Equal.

B. Switch Types: *Pass & Seymour* model numbers are listed below to establish configuration and type of switch. Equal devices by other manufacturers will be accepted.

C. SPST Switches:
1. Description: NEMA WD 1, commercial, specification grade, AC only general-use snap switch, back and side wired.
2. Device Body: Ivory plastic with toggle handle.
3. Voltage Rating: 120-277 volts, AC.
4. Current Rating: 20 amperes.
5. Model Number: CS20AC1-I

D. 3-Way Switches:
1. Description: Identical to SPST switches except 3-way operation.
2. Model Number: CS20AC3-I.

E. Boiler Cut-Off Switches:
1. Description: DPST switch with red handle.
2. Voltage Rating: 120-277 volts AC.
3. Current Rating: 20 Amperes.
4. Faceplate: Red color, engraved “EMERGENCY.”
5. Model Number: PS20AC2-RED

2.2 DOOR JAMB SWITCHES

A. Manufacturers:
1. *Pass & Seymour*
2. Substitutions: Or Approved Equal.

B. Switch Types: *Pass & Seymour* model numbers are listed below to establish configuration and type of switch. Equal devices by other manufacturers will be accepted.

C. Door Jamb Switches:
1. Description: NEMA WD-1 interior pressure-activated switch with wiring leads, plunger, and face plate. Switch contacts shall be normally open when door is closed and shall turn closet light on when closet door is opened.
2. Switch Box: Steel.
3. Face Plate: Steel with bronze coating.
4. Voltage Rating: 120 VAC.
5. Current Rating: 15A.
6. Model Number: 1205A.

2.3 RECEPTACLES

A. Manufacturers:
1. *Hubbell.*
2. *Leviton.*
3. *Bryant.*
4. *Pass & Seymour*
5. Substitutions: Or Approved equal.

B. Receptacle Types: *Pass & Seymour* model numbers are listed below to establish configuration and type of receptacles. Equal devices by other listed manufacturers will be accepted.

C. General Use:
1. Description: NEMA WD 1; commercial, specification grade, 125-volt grounded duplex receptacle, back and side wired.
2. Device Body: Ivory, nylon face.
3. Configuration: NEMA 5-20.
4. Model number: BR20-I.

D. Tamper-Resistant:
1. Description: NEMA WD 1; specification-grade, tamper-resistant, 125-volt grounded duplex receptacle, back and side wired.
2. Device Body: Ivory, nylon face.
3. Configuration: NEMA 5-20.
4. Model number: TR63-I

E. Standard Ground Fault:
1. Description: UL 498, 544, 943; specification-grade, 125-volt, ground-fault interrupt type duplex receptacle with TEST and RESET, side wired.
2. Device Body: Ivory, Thermoplastic.
3. Configuration: NEMA 5-15R.
4. Model Number: 2095-I.

F. Tamper-Resistant Ground Fault:
1. Description: UL 498, 544, 943; specification-grade, tamper-resistant, 125-volt, ground-fault interrupt type duplex receptacle with TEST and RESET, side wired.
2. Device Body: Ivory, Thermoplastic.
3. Configuration: NEMA 5-15R.
4. Model Number: 2095-TRI.

G. Electric Range:
1. Description: 125/250 volt, 50-ampere surface receptacle.
2. Device Body: Black thermoplastic.
3. Configuration: NEMA 14-50R.
4. Model Number: 3854/3854-40.

2.4 WALL PLATES

A. Manufacturers:
1. *Hubbell.*
2. *Leviton.*
3. *Bryant.*
4. *Pass & Seymour.*
5. Substitutions: Or Approved Equal.

B. Description: Smooth plastic, ivory.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on top.

E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

H. For non-dwelling unit locations, provide standard GFIC-type receptacles at all receptacle locations within six (6) feet of a sink, whether indicated as such on the Drawings or not.

I. For dwelling unit locations, provide tamper-resistant type receptacles at all locations. Provide tamper-resistant GFIC-type receptacles in kitchens (except dishwasher and refrigerator receptacles) and in bathrooms.

J. Install light switches 48 inches above finished floor. Install standard receptacle outlets 18 inches above finished floor. Install receptacle outlets above counters at heights as indicated on drawings.

K. For dwelling unit locations, provide receptacle outlets such that no point measured horizontally along the floor line in any wall space is more than six feet from a receptacle outlet. Wall space shall be defined as any space two feet or more in width (including space measured around corners) and unbroken along the floor line by doorways, or similar openings. The Contractor shall confirm that this condition has been met prior to rough-in of receptacle outlets.

L. For dwelling unit locations, provide wall countertop receptacle outlets such that no point along the countertop line is more than 24 inches measured horizontally from a receptacle outlet. At island countertops, provide receptacle outlets with at least one receptacle installed at each island with a long dimension of 24 inches or greater and a short dimension of 12 inches or greater. The Contractor shall confirm that this condition has been met prior to rough-in of receptacle outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 25 05 33 to obtain mounting heights specified and indicated on Drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above floor, or as noted on the Drawings.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 27 26

SECTION 26 28 16

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disconnect Switches.

B. Fuses.

1.2 REFERENCES

A. NEMA KS 1 - Enclosed Switches.

B. ANSI/NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 26 00 00.

B. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Acceptable manufacturers:
1. *Square D*.
2. *General Electric*.
3. *Cutler-Hammer*.
4. *Siemens*.
5. Substitutions: Or Approved Equal.

B. Nonfusible Switch Assemblies: NEMA KS 1; Type HD; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front with switch in ON position. Handle lockable in OFF position.

C. Fusible Switch Assemblies: NEMA KS 1, Type HD, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: designed to accommodate Class R fuses.

D. Enclosures: NEMA KS 1; Type 1. For indoor locations; Type 3R for outdoor locations.

2.2 FUSES

A. Acceptable manufacturers:

1. *Bussman.*
2. *Shawmut-Gould*
3. Substitutions: Or Approved Equal.

B. Fuses 600 amperes and less: ANSI/UL 198E, Class RK5 dual element 250-volt.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches for all motor loads and where indicated on Drawings, except where equipment is factory supplied with an integral means of disconnect.

B. Install disconnect switches within sight and within 25 feet of equipment item being served. Install switch handle no higher than 60 inches above the working surface.

C. Provide unfused disconnect switches for general motors. Provide fused disconnect switches for elevator controller, feeder and for elevator cab branch circuit power.

D. Provide a mechanical interlock contact on the elevator main power disconnect switch of use by elevator control wiring.

END OF SECTION 26 28 16

SECTION 26 29 13

ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual motor starters.

B. Combination magnetic motor starters.

1.2 REFERENCES

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

B. NEMA AB 1 - Molded Case Circuit Breakers.

C. NEMA ICS 1 - Industrial Control Devices, Controllers, and Assemblies.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 00 00.

B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 00 00.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

PART 2 - PRODUCTS

2.1 MOTOR STARTERS

A. Acceptable Manufacturers.
   1. *Square D.*
   2. *General Electric*.
   3. *Siemens*.
   4. *Allen-Bradley*.
   5. Substitutions: Or Approved Equal.

B. Manual Motor Starters:
   1. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, 1 pole, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, and toggle operator.

2. Enclosure: ANSI/NEMA ICS 6; Type 1 for interior locations, Type 4 for exterior locations.

C. Magnetic Motor Starters:
1. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
2. Full Voltage Starting: Non-reversing type.
3. Coil Operating Voltage: 120 volts, 60 Hertz.
4. Size: NEMA ICS 2; size as shown on Drawings.
5. Overload Relay: NEMA ICS 2; bi-metal.
6. Enclosure: NEMA ICS 6; Type 1 for interior locations, Type 3R for exterior locations.
7. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure.
8. Auxiliary Contacts: NEMA ICS 2; two and field convertible contacts in addition to seal-in contact.
9. Control Transformers: 240V : 120V; 0.5 kVA, primary fused.
10. Indicating Lights: NEMA ICS 2; RUN: green in front cover.
11. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO in front cover.
12. Relays: NEMA ICS 2.

D. Controller Overcurrent Protection and Disconnecting Means:
1. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer’s instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

D. Mount combination type motor starters locally to equipment being served, with top at 60 inches (maximum) above adjacent floor, with not less than 36 inches clearance in front of starter (floor to ceiling).

END OF SECTION 26 29 13

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior lighting fixtures, lamps, and ballasts.

B. Lighting fixture supports.

1.2 REFERENCES

A. Section 26 05 50.16 – Lighting Fixture Schedule

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 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.
   3. Energy-efficiency data.

B. Operation and Maintenance Data: For lighting equipment.

C. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

1.6 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.

1.7 WARRANTY

A. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

1.8 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. Lamps: 10 of each type and rating installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Luminaires:
   1. Provide products as specified in Interior Lighting Fixture Schedule.

B. Electronic Fluorescent Ballasts for T8 Lamps
   1. 1-Lamp non-dimming ballasts:
      a. *Sylvania* QTP 1x32T8/UNV ISN-TC Series
   2. Substitutions: Equivalent ballasts by *Advance* or *Universal*.
   3. 2-Lamp non-dimming ballasts:
      a. *Sylvania* QTP 2x32T8/UNV ISN-TC Series
      b. Substitutions: Equivalent ballasts by *Advance* or *Universal*.

C. Electronic Compact Fluorescent Ballasts
   1. Non-dimming ballasts
      a. *Sylvania* QTP 1/2x13CF/UNV (two lamp 13 watt)
      b. *Sylvania* QTP 1/2xCF/UNV (single 26 watt)
      c. *Sylvania* QTP 2x26/32/42CF/UNV (two-lamp 26 watt)
      d. Substitutions: Equivalent ballasts by *Advance* or *Universal*.

D. Lamps:
   1. *Osram Sylvania*
   2. *General Electric*
   3. *Philips*
   4. Substitutions: None Permitted.

2.2 STANDARD NON-DIMMING BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output.

B. T8 Fluorescent Lamps
   1. Starting Method: Instant Start
   2. Ballast Factor: 0.88 (minimum)
   3. Circuit Type: Parallel
   4. Lamp Frequency: > 40 kHz
   5. Lamp CCF: < 1.7
   6. Starting Temperature: 60 F
   7. Input Frequency: 60 Hz
   8. Total Harmonic Distortion (THD): <10%
   9. Power Factor: >98%
   10. Voltage: Universal 120-277 volts
   11. Maximum Input Wattage:
      a. Single Lamp, T8, 28-Watt: 25 Watts at 120V
      b. Two Lamp T8, 28-Watt: 48 Watts at 120V

2.3 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
   1. Starting Method: Programmed Rapid-Start (quad and triple-tube lamps); Instant Start (PL lamps)
   2. Ballast Factor: 0.96 (minimum)
   3. Circuit Type: Series (quad and triple-tube lamps); Parallel (PL lamps)
   4. Lamp Frequency: > 40 kHz
   5. Lamp CCF: < 1.7
   6. Starting Temperature: 5 F (-20 C)
   7. Input Frequency: 60 Hz
   8. Total Harmonic Distortion (THD): <10%
   9. Power Factor: >97%
   10. Voltage: Universal 120-277 volts
   11. Maximum Input Wattage:
      a. Two Quad-Tube Lamp T4, 13-Watt: 29 Watts
      b. Single Quad-Tube Lamp T4, 26-Watt: 28 Watts
      c. Two Quad-Tube Lamp T4, 26-Watt: 54 Watts

2.4 FLUORESCENT AND COMPACT FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. 17-Watt, T8 Fluorescent Lamps:
   1. Base: Medium Bi-Pin
   2. Initial Lumens: 1350 (minimum @ 77 F)
   3. Mean Lumens: 1240 (minimum @ 77 F)
   4. CCT: 3500K
   5. CRI: 82 (minimum)
   6. Life: 20000 hours (3 hours/start)

C. 28-Watt, T8 Fluorescent Lamps:
   1. Base: Medium Bi-Pin
   2. Initial Lumens: 2725 (minimum @ 77 F)
   3. Mean Lumens: 2590 (minimum @ 77 F)
   4. CCT: 3000K

5. CRI: 85 (minimum)
6. Life: 36000 hours (3 hours/start)

D. 14-Watt, T5 Fluorescent Lamps:
1. Base: Mini Bi-Pin
2. Initial Lumens: 1200 (minimum @ 77 F)
3. Mean Lumens: 1116 (minimum @ 77 F)
4. CCT: 3500K
5. CRI: 85 (minimum)
6. Life: 20000 hours (3 hours/start)

E. 13-Watt, T4 PL Lamps:
1. Base: 2-pin, 2GX7
2. Initial Lumens: 780
3. Mean Lumens: 671
4. CCT: 2700K
5. CRI: 82
6. Life: 10000 hours (3 hours/start)

F. 13-Watt, T4 Quad Tube Lamps:
1. Base: 4-pin, G24Q-1
2. Initial Lumens: 900
3. Mean Lumens: 774
4. CCT: 2700K
5. CRI: 82
6. Life: 12000 hours (3 hours/start)

G. 26-Watt, T4 Quad Tube Lamps:
1. Base: 4-pin, GX24q-3
2. Initial Lumens: 1710
3. Mean Lumens: 1470
4. CCT: 2700K
5. CRI: 82
6. Life: 12000 hours (3 hours/start)

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 29 "Supporting Devices" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Do not use grid as a sole support element.
1. Install a minimum of four ceiling support system rods or wires 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 (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Aim adjustable accent lighting fixtures as directed by the Engineer.

E. Install fixtures in full conformance with manufacturers' instructions.

END OF SECTION 26 51 00

SECTION 26 52 00

EMERGENCY LIGHTING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Emergency lighting units.

1.2 REFERENCES

A. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

B. NEMA WD1 - General Purpose Wiring Devices.

1.3 REGULATORY REQUIREMENTS

A. Conform to NFPA 101 for installation requirements.

1.4 RELATED SECTIONS

A. Section 26 05 50.16 - Lighting Fixture Schedule

1.5 SUBMITTALS

A. Submit product data under provisions of Division 01 and Section 26 00 00.

B. Provide product data on emergency lighting units.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of each luminaire.

PART 2 - PRODUCTS

2.1 INCANDESCENT EMERGENCY LIGHTING UNITS

A. Emergency Lighting Unit: Self-contained unit with rechargeable storage batteries, charger, and lamps.

B. Battery: 12 volt, nickel-cadmium type, with 1.5-hour capacity to supply the connected lamp load.

C. Charger: Dual-rate charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to fully charged within 12 hours.

D. Lamps: 20-watt minimum, MR16 halogen type.

E. Indicators: Provide lamps to indicate AC ON and RECHARGING.

F. Provide switch to transfer unit from normal supply to battery supply.

G. Unit Voltage: 120 volts, AC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb and level.

B. Aim directional lampheads as directed.

C. Connect power to emergency lighting units to nearest lighting circuit ahead of all switches.

D. Provide wiring as indicated on drawings.

END OF SECTION 26 52 00

SECTION 26 56 00

EXTERIOR 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. This Section includes the following:
   1. Exterior luminaires with lamps and ballasts.

1.3 RELATED SECTIONS

A. Section 26 06 50.16 - Lighting Fixture Schedule.

1.4 DEFINITIONS

A. CRI: Color-rendering index.

B. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 and Section 26 00 00.
B. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
   2. Details of attaching luminaires and accessories.
   3. Details of installation and construction.
   4. Luminaire materials.
   5. Ballasts, including energy-efficiency data.
   6. Lamps, including life, output, and energy-efficiency data.

1.6 QUALITY ASSURANCE

A. 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.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

B. Warranty Period for Luminaires: one year from date of Substantial Completion.

C. Warranty Period for Lamps: Replace lamps and fuses that fail within 1 month from date of Substantial Completion.

1.8 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. Lamps: 5 of each type and rating installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Lighting Fixture Schedule in Section 26 06 50.16 provide products as specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

D. Exposed Hardware Material: Stainless steel.

E. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.3 FLUORESCENT BALLASTS AND LAMPS

A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F and higher.

B. Ballast Characteristics:
   1. Power Factor: 90 percent, minimum.
   2. Sound Rating: A.
   3. Total Harmonic Distortion Rating: Less than 10 percent.

C. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.

D. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.

E. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F and higher.

F. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

C. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

END OF SECTION 26 56 00

SECTION 27 00 00

GENERAL COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying drawings, including work related to:
   1. Telecommunications site services.
   2. Cable television system, including outlets and wiring.
   3. Voice/data network system including wiring, equipment racks, outlets and wiring.

B. Include any minor items of work necessary to provide a complete and fully operative electrical system.

C. The Contractor for this work is referred to Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 01. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 01 supersede and must be satisfied by the Contractor.

1.2 RELATED SECTIONS

A. Section 26 05 26 – Grounding.

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

C. Section 27 10 00 – Structured Cabling.

D. Section 27 15 00.23 - Video Cabling System.

E. Section 28 13 00 – Door Entry Access Control System.

F. Section 28 31 13 – Fire Alarm System.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. OSHA 1910 - Occupational Safety and Health Act.

1.4 GENERAL REQUIREMENTS

A. Contractor shall read the entire specifications covering other branches of work. He is responsible for coordination of his work with work performed by other trades.

B. Consult all Contract drawings which may affect the location of any equipment or apparatus furnished under this work and make minor adjustments in location as necessary to secure coordination. Contractor shall consult architectural interior elevations for mounting heights of telecommunications outlets and clocks.

C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of work.

D. Contractor shall contact the Owner's Representative immediately if he notices any discrepancies or omissions in either the drawings or the specifications, or if there are any questions regarding the meaning or intent thereof.

E. Submit all changes, other than minor adjustments, to the Architect for approval before proceeding with the work.

1.5 SUBMITTALS

A. Submit under provisions of the following and Division 01.

B. Submittal shall include complete Specifications, including type of materials, electrical characteristics, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted shall be complete and shall apply only to this specific project. All extraneous material shall be deleted or marked out. Items to be supplied shall be specifically indicated using a method that will be visible after photocopying.

C. Regardless of any information included in the submittal submitted for review, the requirements of the Drawings and Specifications shall not be superseded in any way by the review. Review by the Architect-Engineer does not relieve responsibility for submittal errors or from meeting the requirements of the Contract Documents.

D. It is intended that Submittal data be complete and accurate at the first submission. If the Submittal is returned marked "Resubmit" only one additional submission will be permitted.

E. Submit related Submittal at one time. SUBMIT ALL ITEMS IN A SPECIFICATION SECTION AT THE SAME TIME. Incomplete submittal will be held until a complete submittal is accumulated or may be rejected without further review and returned to the applicable parties. Include a copy of the Specification Paragraphs pertaining to the items submitted.

F. If proposed equipment deviates from the Specifications or Drawings, indicate in writing on Company letterhead those differences and provide sufficient data to justify acceptance. FAILURE TO INDICATE DEVIATIONS OR SUBSTITUTIONS IMPLIES FULL COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

G. The term "by others" or similar wording shall not be used on Submittal. Submittal shall state by whom related items of work are to be provided. Where not indicated, it is implied that the work or item is provided under this Section.

H. Shop Drawings: Provide shop drawings as required by the individual Specification Sections. Submit shop drawings indicating physical size and arrangement, (plans and elevations) construction details, provisions for conduits, access requirements for installation and maintenance, finishes, and materials used in fabrication for all equipment. Supplement shop drawings with wiring diagrams for all systems with wiring connections for multiple components.

I. Submittals shall be made as paper copies. Submittals transmitted only by electronic email shall not be accepted.

1.6 REGULATORY REQUIREMENTS

A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:
   1. State Building Codes.
   2. Specific Construction Safety Requirements, State Industrial Commission.
   3. National Electrical Code - NFPA 70.
   4. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.

B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes and ordinances, and they are thereby included in these specifications. All work shall comply with the 2008 edition of NFPA 70, The National Electrical Code. It shall be the Contractor’s responsibility to assure that electrical work is in full compliance with the NEC.

C. The Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

D. Obtain and pay for all necessary permits. Request inspections from authority having jurisdiction.

1.7 RECORD DRAWINGS

A. Record any changes in location of equipment items, telecommunications outlets, and similar construction items on a set of prints and deliver them to the Owner’s Representative upon completion of the work.

1.8 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide a Complete Instruction and Maintenance Manual: Prepare in the form of an instructional manual for use by Owner's personnel. Provide one (1) draft copy and two (2) final copies.
   1. Format:
      a. Size: 8-1/2" x 11", 20 lb. minimum weight white paper for typed pages, either manufacturer's printed data, or neatly typewritten.
      b. Drawings: Provide reinforced punched binder tab, bind in with text. Fold larger drawings to size of text pages. Clear plastic "binding tape" (not "Scotch" tape) applied to edge of sheet and then punched is acceptable.

c. Single-sheet product literature and contractor-prepared pages: Provide reinforced punched binder tab. Clear plastic "binding tape" (not "Scotch" tape) applied to edge of page and then punched is acceptable.
d. Provide indexed tabs and flyleaf for each separate product, or each piece of operating equipment. Include typed description of product, and major component parts of equipment.
e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
f. Binders:
   1) Commercial quality three-ring binders with durable and cleanable plastic covers, 1" minimum, 2" maximum ring size.
   2) When multiple binders are used, collate the data into related consistent groupings and provide a spine label that includes the volume number and contents of the binder.

B. Provide content as listed in separate Sections of Division 27 of these specifications.

1.9 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.10 COORDINATION WITH WORK PROVIDED UNDER DIVISION 26

A. Telecommunications work shall be coordinated with associated work being provided under Division 26. Work provided under Division 26 shall include the following:
   1. Raceway and Boxes for wiring.
   2. 120-volt power circuits.

1.11 COORDINATION WITH WORK PROVIDED UNDER OTHER DIVISIONS

A. Division 14 - Elevator: Provide telecommunications outlets and associated wiring as required by the elevator supplier for the Elevator Machine Room and for the elevator cab.

B. Division 28 – Alarms: Provide telephone wiring and connections to the fire alarm control panel as specified under Section 28 31 13.

1.12 COORDINATION WITH OWNER FURNISHED ITEMS

A. Provide telecommunications wiring to support the door entry access control system as specified under Section 28 13 00.

1.13 UTILITY SERVICE WORK

A. The Contractor shall make arrangements with *FairPoint* and *Time-Warner* to provide new underground telephone/data/cable TV utility services extending from the existing utility service

pole at Crescent Street to service demarcation boxes at the exterior of the building on the building southeast corner. Service arrangements shall be coordinated with the Owner.

B. The Contractor shall provide interior service cables for telephone and cable television extending from the exterior service demarcation point to the service backboard located in the Ground Floor Mechanical Room G06.

C. Conduit for underground telecommunications cable shall be provided under Division 26.

D. Interior telephone service cable shall be as specified under Section 27 10 00.

E. Interior cable television service cable shall be as specified under Section 27 15 00.13.

1.14 SUBSTANTIAL AND FINAL COMPLETION

A. Refer to General Conditions and Supplementary Conditions.

B. Substantial Completion shall not be considered unless all systems are tested and verified for adherence with Contract Documents and any work remaining is less than one percent of the total Contract Value of this Section.
   1. Record Drawings, Operation and Maintenance Manuals, Acceptance Demonstrations, Owner personnel training, spare parts or extra materials required, test reports, warranties and certifications of installation inspections shall be submitted and accepted prior to Substantial Completion.

C. Final Completion shall be when all work under this Section is completed as defined by the Contract Documents and accepted by the Architect-Engineer.

D. When Architect-Engineer determines Work is complete, close out submittals will be considered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish new and undeteriorated materials and of a quality not less than what is specified.

B. The selection of materials and equipment to be furnished shall be governed by the following:
   1. Where single trade name, brand of manufacturer or material is listed in the specification, the exact equipment listed shall be used in the bid.
   2. Where more than one name is listed, Contractor may select any one of the several brands specified.
   3. Where trade name, brand of manufacturer of equipment or material is listed in the specification followed by the word “or approved equal,” the Contractor may substitute product of equal quality from another manufacturer for consideration by the Engineer.

C. Conduit shall be as specified under Section 26 05 33.

PART 3 - EXECUTION

3.1 PROTECTION AND CLEANING

A. Protect all telecommunications work and products against damage during construction and pay the cost of repair or replacement of telecommunications products made necessary by failure to provide suitable safeguards or protection. After all work has been inspected and approved, thoroughly clean all equipment, provided under this work.

END OF SECTION 27 00 00

SECTION 27 10 00

STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section of the specification includes the furnishing, installation, connection and testing of a complete Structured Cabling System (SCS). The SCS is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire, patch panels, patch cords, telecommunication outlets, UTP and fiber optic cable installed and configured to provide a computer data, and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network. Provide all equipment required to form a complete, operative, and coordinated system as shown on the drawings and specified herein. Components of the SCS shall include, but are not limited to, the following:
   1. Voice/data data network racks.
   2. Network patch panels.
   3. Voice/data data network outlet jacks.
   4. Intra-building telecommunications cable.
   5. Network patch cords.
   6. Interior telephone service cable.

1.2 RELATED SECTIONS

A. Section 27 00 00 – General Communication Requirements.

B. Section 26 05 26 – Grounding.

C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

A. ANSI/TIA/EIA 568A - Electronic Industries Association Telecommunications Industry Association - Commercial Building Telecommunications Wiring Standards.

B. ANSI/TIA/EIA 568-A1 - Propagation Delay and Delay Skew specifications.

C. ANSI/TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.

D. ANSI/TIA/EIA TSB-67 - Transmission Performance Specifications for Field Testing of Unshielded. Twisted Pair Cabling Systems, October 1995.

E. ANSI/TIA/EIA TSB-72 - Centralized Optical Fiber Cabling Guidelines, October 1995.

F. ANSI/TIA/EIA TSB-75 - Additional Horizontal Cabling Practices for Open Offices.

G. ANSI/TIA/EIA 607 - Grounding and Bonding Requirements for Telecommunications in Commercial Buildings.

H. ANSI/TIA/EIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

I. Institute of Electrical and Electronics Engineers (IEEE)

1.4 QUALIFICATIONS

A. Installer: Company specializing in the installation of telecommunications systems, including installation and certification of "Category 6" cabling. Company shall have five (5) years (minimum) documented experience on completed projects. All work shall be performed and supervised by telecommunications technicians who are qualified to install voice, data and image cabling systems and to perform related tests. The telecommunications technicians employed shall be fully trained and qualified by the manufacturer of the test equipment for the installation. Evidence that the Contractor is a current certified installer of the manufacturer must be provided in writing prior to commencing work.

B. System: The cabling system shall conform to the current of industry standard ANSI/TIA/EIA 568A. Certification shall be provided that the system will support applications for which it is designed including Category 6 intra-building telecommunications cable performance.

1.5 QUALITY ASSURANCE

A. Contractor Quality Assurance:
1. Provision of all manufactured components, installation, wiring, and testing shall be the responsibility of a single contractor.
2. Maintain the same person in charge of work throughout installation.
3. Supply and install any incidental equipment needed in order to result in a complete and operable system.
4. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.
5. Unless otherwise specified, supply only new equipment, parts and material, and operate only as required for testing as part of installation procedure.

B. Manufacturer Quality Control for Telecommunications Data Network Systems
1. All systems components and products specified shall be supplied by a single manufacturer, with the exception data racks and other hardware that is not defined as part of the channel test configuration by TIA/EIA TSB67, Transmission Performance Specifications for Field Testing of unshielded Twisted-Pair Cabling Systems and shall be as specified herein. Unless the words "Or Approved Equal" are included, only the manufacturers listed will be considered.
2. Each system is to be fully tested upon completion of installation in accordance with PART 3 - EXECUTION of this specification.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 27 00 00 and Division 01.

B. Product Data: Submit catalog data sheets or other published materials showing appearances,

electrical ratings characteristics and connection requirements, performance characteristics, dimensions, weights, installation methods, and space requirements of equipment and their accessories, as listed below and required by the individual paragraphs:

1. Identification Methods
2. Grounding and Bonding
3. Test Report Formats
4. Test Equipment
5. Test Procedures

1.7 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 27 00 00 and Division 01.

B. Accurately record location of voice/data outlets.

1.8 TELEPHONE SERVICE

A. Telephone service shall be provided as specified in Section 27 00 00.

1.9 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions. Include wire and cable lengths within 10 feet of length shown for all local data outlets.

C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

D. PRIOR TO BEGINNING ANY WORK the Contractor shall coordinate the proposed layout of the telecommunications closet as well as intended wiring layouts to confirm maximum allowable wiring drop distances as specified herein.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Division 01 and Section 27 00 00.

B. Prepare three sets of Owner and Maintenance containing Manufacturer" catalogs, other similar data including the necessary photographic equipment cuts, wiring diagrams and final reviewed Shop Drawings and Product Data covering all equipment and devices furnished or installed under this Section. These manuals shall provide complete instructions for the proper operation and use of the equipment together with instructions for lubrication and periodic maintenance and for trouble shooting. Operating instructions shall be specific for each system and shall include copies of posted specific instructions. This manual shall contain only that information which specifically applies to this project and all unrelated material shall be deleted or clearly crossed out.

C. Provide name, address and telephone number of the manufacturer's representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.

1. Include copies of manufacturer's and Installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.

D. Include copies of all test reports and certifications.

PART 2 - PRODUCTS

2.1 UNSHIELDED TWISTED PAIR (UTP) CABLING SYSTEM

A. Approved Manufacturers:
1. *Belden*
2. *CommScope*
3. *Berk-Tek*
4. *General Cable*
5. *Mohawk*
6. Substitutions: Or Approved Equal.

B. UTP Pin/pair Termination Assignment: The UTP cabling systems shall have TIA/EIA T568B pin/pair termination assignment. All conductors provided shall be properly and consistently terminated at both ends throughout the entire systems.

C. Horizontal Cable -Voice & Data:

1. Voice Cable shall be TIA/EIA Category 5e Unshielded Twisted Pair (UTP) cable, as specified.
2. Electrical Characteristics for 24 AWG Extended Frequency Category 6 cable:
   a. DC Resistance (max) 8.9
   b. DC Resistance Unbalanced (max) 3.0
   c. Input Impedance, 1.0 to 100 MHz =100 +/- 15, 100 to 350MHz = 100 +/- 22
   d. Characteristics Impedance, 1 to 350 MHz = 100 +/- 15%
   e. ACR @ 100KHz, db (min) of 21
   f. PS-ACR @ 100MHz, db (min) of 19
   g. Delay Skew (max) ns/100m is 25
   h. Nominal Velocity of Propagation (NVP), % speed of Light, 70
3. Electrical Characteristics:

Frequency	Max. Atten. Db/100m	ELFEXT bd (min)	PS-ELFEXT bd (min)	PS-NEXT bd (min)	NEXT bd (min)	SLR db (min)	Return Loss db (min)
772kHz	1.8	66	63	70	72	-	-
1MHz	2.0	64	61	68	70	24.5	20.0
4MHz	4.1	52	49	59	61	24.5	23.0
8MHz	5.8	46	43	54	56	24.5	24.5
10MHz	6.5	44	41	53	55	24.5	25
16MHz	8.2	40	37	50	52	24.5	25.0
20MHz	9.3	38	35	48	50	24.5	25.0

25MHz	10.4	36	33	47	49	24.0	24.3
31.25MHz	11.7	34	31	45	47	23.5	23.6
62.5MHz	17.0	28	25	41	43	22.0	21.5
100MHz	22.0	24	21	38	40	21.0	20.1
155MHz	28.1	20	17	35	37	20.1	18.8
200MHz	32.4	18	15	33	35	19.5	18.0
300MHz	41.0	14	11	31	33	18.6	16.8
350MHz	44.9	13	10	30	32	18.3	16.3

1. Compliance of 24 AWG Extended Frequency Category 5e cable:
   a. ISO/IEC 11801
   b. ANSI/TIA/EIA 586-5 (Category 5e)
   c. ANSI/ICEAA S-90-661 (Category 5X-100)
   d. NEWA WC 63.1 (Category 5)
   e. UL Listed Type MPR/CMR
   f. (UL) CMG
2. Non-plenum rated cable - CM rated jacket for Non-plenum applications.
3. Plenum rated cable - CMP rated jacket for Plenum applications.
4. Riser rated cable - CMR rated jacket for Riser applications.

E. Backbone Cable-Voice (Category 6)
1. TIA/EIA Category 5e Unshielded Twisted Pair (UTP)
   a. Able shall meet or exceed all current specifications for Category 5e cable per EIA/TIA, 24AWG, 25-pair cable.
   b. Backbone cable shall match-up all pairs (4-pairs from each work area outlet) to the MDF.
   c. Non-plenum rated cable - CM rated jacket for non-plenum rated applications.
   d. Plenum-rated cable – CMP rated jacket for plenum rated applications.
   e. Riser rated cable – CMR rated jacket for Riser applications.

F. Patch Panels
1. Patch panels shall be EIA nineteen inch (518mm), rack mounted, TIA/EIA Category 5e, UL Category 5e type patch panels with integral printed circuit board, color-coded, high density, IDC type terminations and 8 position modular jacks. Keyed jacks are not allowed. Jacks shall be able to withstand at least a minimum of 2000 mating cycles without any transmission degradation.

2.3 CABLE SUPPORTS

A. Manufacturers:
1. J-Hooks: *Caddy*, *Chatsworth*, or *Mono-System*.
2. Cable Ties: *DEK*, *Panduit*, *AMP*, *3M*, or *T&B*.

B. J-Hooks shall be sized to correctly support the number of cables which pass through them. Under no circumstances shall cable quantity exceed 14 in any given support. J-Hooks shall have a maximum of 40% fill capacity.

C. Cable ties shall be correctly sized to support the quantity and types of cables installed.

2.2 110 WIRING BLOCKS/CROSS CONNECTOR BLOCKS

A. Cross Connector Blocks Manufacturers:
   1. *Ortronics* model OR-30600150/OR-110ABC6050
   2. Substitutions: or approved equal

B. Description: 200-pair 19" x 7" rack mount panel with 110 wiring blocks. Provide termination kit and termination labels.

2.3 TELECOMMUNICATIONS DATA NETWORK RACK

A. Description: Wall mounted 23" high by 14" deep equipment racks shall be provided. Racks shall include two (2) 48-port, CAT 5e rated cable patch panels for local cabling. The rack shall include an electrical power strip and a 500 VA rated uninterruptible power supply (UPS) unit. Also located within these racks will be system routers and switches as required, to be purchased and installed by the Owner. The wall mounted cabinet shall be *Blackbox* #RM335A, or approved equal.

2.4 SURGE PROTECTED POWER STRIP

A. Manufacturers:
   1. *Wiremold*
   2. *Sentrex*
   3. *TrippLite*
   4. *S.L. Weber*
   5. Substitutions: Or approved equal

B. Surge protected power strip shall be rack mount type.

C. Surge protected power strip with six NEMA 5-15R outlets 15 amp capacity, 120 volts, UL 1449 listed, maximum surge current of 33,000 amps, clamping voltage of 260 volts, maximum 5 picosecond response time, resettable overload circuit breaker, surge suppression warning light, surge protection for line to neutral, line to ground, neutral to ground, EMI/RFI filters. One required for each load up to 1200 watts (total of individual equipment loads).

2.5 RACK MOUNTED UPS

A. Manufacturers:
   1. *APC* Model SUA1000RM2U.
   2. Substitutions: Or approved equal.

B. Description: Rack mounted uninterruptible power supply unit rated to operate 670 watts for 8.8 minutes or 335 watts for 29.9 minutes.
   1. Output Capacity: 670 watts/1000 VA.
   2. Nominal Output Voltage: 120 volts.
   3. Output Connections: (6) NEMA 5-15R.
   4. Input Voltage: 120 volts.
   5. Input Connections: NEMA 5-15P (8 foot cord).
   6. Battery Type: Maintenance-free sealed lead acid.
   7. Battery Recharge Time: 3 hours.

2.6 VOICE/DATA OUTLET BOXES

A. Outlet Boxes: Sheet-metal or plastic as specified in Section 26 05 33.

2.7 TELECOMMUNICATIONS DATA NETWORK OUTLET JACKS

A. Manufacturers:
   1. *Leviton* "Quickport" Series
   2. *AMP*
   3. *Hubbell*
   4. *Ortronics*
   5. *Panduit*
   6. Substitutions: Or approved equal.

B. Each Outlet shall consist of the following:
   1. Single gang or dual gang face plate shall be thermoplastic (nylon) with number of voice, data, video and sound jacks as indicated in the Specifications and Drawings.
   2. Electrical Subcontractor shall provide 4" square backboxes for all Single gang and Dual gang outlet face plates. Provide single gang and dual gang plaster rings for the specified Single gang and Dual gang outlet face plates.
   3. Refer to Electrical drawings for placement of outlets.
   4. Outlets:
      a. Data/Voice Outlet – shall consist of one (1) blue color modular Category 5e RJ-45 8-position connector and one (1) grey color modular Category 6 RJ-45 connector, both mounted on a single-gang faceplate.
         1) One (1) RJ-45 connector (blue) shall be used for data and one (1) RJ-45 connector (grey) shall be used for voice. Connectors shall be cabled to relevant IDF/MDF patch panels with two (2) 4-pair Category 6 unshielded twisted pair cables.

2.8 BONDING AND GROUNDING JUMPER CABLE

A. Manufacturer: Provide products meeting the requirements of the Drawings and Specifications from one of the following manufacturers:
   1. *Belden* (No. 8669)

B. Jumper cable shall be hollow braided, 60 amp capacity, copper.

C. Provide equal conduct of as described in "B" above for aluminum equipment.

D. Jumpers shall have compression or exothermic type terminals on both ends of cables. Terminals shall be compatible with jumper cable material and equipment material in order to not have any degenerative reaction.

2.9 EQUIPMENT/CABLE IDENTIFICATION

A. All equipment and cabling shall be properly identified by means of clear and concise labels. All identification shall meet or exceed the minimum requirements of EIA/TIA568A, 606 and BICSI standards.

B. Permanently label, using pre-printed labels, all cables and terminations. Handwritten or embossed type labels are specifically prohibited.
   1. Label all equipment racks, panels and cross connect blocks uniquely.
   2. Label patch panels and cross connect blocks numerically, top-to-bottom.
   3. Label cable segments by designated incoming cable.

C. Labels
   1. Provide color-coded labels with CODED identifiers as follows:
      a. Cable pathways shall be labeled at all end points including equipment rooms, telecommunications closets, pull boxes and the like. Provide adhesive labels on the conduit with at least one label within each space that the conduit passes through. Labels shall be attached by means of the label adhesive and color-coded pressure-sensitive tape wrapped around conduit at least one and one half times.
      b. Cables shall have double lapped adhesive labels at all end points including outlets, telecommunication closets and equipment rooms. Cables shall also have factory imprinted manufacturer's name, part number and the NRTL certified UL EIA/TIA category rating designation at a minimum of two foot (610mm) intervals along the entire length of the cable.
      c. Termination hardware shall have adhesive labels on both the front and rear (if accessible) of the hardware.
      d. Grounding and bonding system shall have engraved labels at each ground bar and backbone grounding cable as it passes through each room. Each bonding jumper shall have heat shrink labels at all end points.
   2. Labels shall be constructed of approved material in order to meet the legibility, defacement, adhesion (adhesive labels only), and exposure requirements of UL 969. All labels shall be mounted horizontally in order to be read from left to right.
      a. Adhesive Labels shall be constructed of color-coded paper with a clear polyester over laminate, Brady USA, Inc. PermaShield, RayChem TMS or approved equal. Adhesive material used shall be approved for material being attached to, typeface shall be medium density, Helvetica, 1/8 inch (3mm) high black characters unless indicated otherwise.
      b. Heat-Shrink Labels shall be constructed of color-coded flame retardant, heat shrinkable polyolefin, Brady USA, Inc, RayChem TMS or approved equal. Typeface shall be medium density, Helvetica 1/8 inch (3mm) high black characters unless indicated otherwise.
      c. Handwritten or embossed labels are not allowed.

2.11 PATCH CORDS

A. Patch cords shall match the characteristics of UTP cable and shall be in lengths as required. Provide terminations at each cable end.
   1. Test each cord according to the requirements listed under paragraph 3.4.
   2. Provide one patch cord for each local outlet drop.

2.12 INTERIOR TELEPHONE SERVICE CABLE

A. Telephone service cable shall consist of 25-pair CAT5e cable and shall match the operating characteristics of UTP cable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on Drawings.

C. Beginning of installation means installer accepts existing conditions.

3.2 VOICE/DATA NETWORK OUTLET JACKS

A. Install and connect data outlet jacks in boxes at locations indicated on Drawings.

B. Install outlet jacks in accordance with manufacturer's instructions.

3.3 VOICE/DATA NETWORK WIRING

A. Provide continuous, unspliced, UTP horizontal drop cable from data/voice patch panels at equipment racks to each local data/voice outlet jack.

B. Intra-building telecommunications cable shall be handled, installed, and supported in conformance with manufacturer's recommendation and EIA/TIA 569. During the laying of cable, the Contractor shall take care not to over stress the cable. After cables are installed, the Contractor shall make sure that all parts of the cable are supported properly and are stress-free at both ends and throughput their length.

C. The Contractor shall insure that the installed bending radius of intra-building telecommunications conforms to the manufacturer's requirements. At no location shall a cable's static or dynamic bending radius be exceeded.

D. Conceal intra-building telecommunications cable within the attic, above accessible ceilings or in walls.

E. Do not make splices in intra-building telecommunications cable.

F. All 4 pairs of each unshielded twisted pair (UTP) intra-building telecommunications cable shall be terminated on a single port. The splitting of cable pairs between different jacks is not permitted.

G. Terminating intra-building telecommunications cable pairs (Category 6) shall have a maximum of 13mm (0.5 inches) of cable untwisted before termination.

H. The Contractor shall confirm routing of all voice/data network circuits to assure that no circuit cable length exceeds 300 feet.

3.4 CABLE TESTING

A. Sub-contract with a independent testing company to test and certify all intra-building telecommunications cabling to identify pair reversal, crossed pairs, opens and shorts. Testing shall comply with ANSI/TIA/EIA 568A, TSB67. Perform test using a network analyzer, Microtest Penta scanner, or approved equal. Test results shall be documented, corrections

implemented and re-testing conducted and documented. In addition, documentation shall be presented to show the length of the cable between outlet jack and the telecommunications rack. Submit written test results for review and acceptance.

3.5 GROUNDING

A. Each equipment rack shall be connected to the telecommunications ground as specified in Section 26 05 26 and in accordance with applicable code requirements as per EIA/TIA 607. Communication bonding and grounding shall be in accordance with the NEC® and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. Provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure), and is independent of equipment or cable. All data equipment shall be properly grounded in the Telecommunications Rooms per manufacturers requirements.

3.6 UPS UNITS

A. Provide a rack mounted UPS unit for all telecommunications equipment racks.

END OF SECTION 27 10 00

SECTION 27 15 00.23

VIDEO COMMUNICATIONS CABLING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide new cable TV interior wiring, wiring taps and outlet jacks.

B. Provide interior cable television service cable.

1.2 RELATED WORK

A. Section 27 00 00 – General Communications Requirements

B. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01 and Section 27 00 00.

B. Product Data: Submit physical and operating characteristics of interior cable and outlet jacks under the provisions of Section 27 00 00 and Division 01.

1.4 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 27 00 00 and Division 01.

B. Accurately record location of cable TV outlets.

1.5 CABLE TELEVISION SERVICE

A. Cable TV service shall be provided as specified in Section 27 00 00.

PART 2 - PRODUCTS

2.1 VIDEO CABLE SYSTEM

A. Approved Manufacturers:
   1. *Belden*
   2. *CommScope*
   3. *General Cable*
   4. Substitutions: Or Approved Equal.

B. The video cable shall be coaxial copper-clad center conductor, foam polyethylene dielectric, quad-shield aluminum-Mylar-aluminum foil type, aluminum braid shield and non-contaminating polyvinyl chloride jacket. Cable shall have 75 ohm impedance with 80 dB shielding. No discontinuity shall exist within 54-216 MHZ and 470-890 MHZ bands. Cable shall be used as follows:

1. Interior service cable shall be equivalent to *CommScope* 5901RG11 Coax Cable.
   a. The interior service cable shall extend between the service demarcation point and the backboard located in the Ground Floor Mechanical Room G06. If field amplification is required to increase dB levels, the amplification hardware must be installed in the Mechanical Room G06.
   b. Interior service cable shall meet or exceed the following nominal attenuation and shall not exceed 1000 feet:

1mhz	.10db/100’
10mhz	.45db/100’
50mhz	.89db/100’
100mhz	1.21db/100’
200mhz	1.68db/100’
400mhz	2.37db/100’
700mhz	3.27db/100’
900mhz	3.77db/100’
1000mhz	3.95db/100’

2. Drop Cable shall be equivalent to *CommScope* RG-6/U, utilize quad-shielding
   a. Plenum-Rated Cable: #2227K CMP rated jacket for Plenum applications.
   b. Drop cable shall meet or exceed the following nominal attenuation specifications and shall not exceed 100 feet to tap on A/V Distribution Trunk/Backbone cable:

1mhz	.21db/100’
10mhz	.65db/100’
50mhz	1.46db/100’
100mhz	2.04 db/100’
200mhz	2.98db/100’
400mhz	4.46db/100’
700mhz	5.89db/100’
900mhz	7.47db/100’
1000mhz	8.02db/100’

C. Video Cable Connectors
1. Connector type shall be compatible with cable type.
2. Connector types:

a. "F" connector - 75 ohm with hexagonal 3/4 inch compression termination.
b. BNC" connector - 75 ohm with hexagonal 3/4 inch compression termination.

D. Video Cabling Splitting Devices
1. Cable tap/splitting devices shall be used in the system as required to meet specified signal strength at each jack location. These units shall utilize a die cast housing and RF shielding exceeding local cable company requirements (minimum -80dB) and be equipped with flanges to permit mounting on any flat surface and shall meet FCC specifications on radiation.
2. Passive Splitters shall have a rated frequency range of 5-1000 Hz and shall be equivalent to Blonder Tongue XRS series.
3. Two-way splitters shall have a maximum splitting loss of 3.8 dB. Four-way splitters shall have a maximum splitting loss of 8.4 dB. Directional couplers shall be available in nominal tap loss values of 8, 12, and 16 dB and the return loss of any terminal shall be 18 dB or higher.
4. Terminating Resistor: Terminating resistors with 75 ohm impedance shall be installed at unused ports and feeder line ends. Terminating resistors shall be designed to cover the frequency range from 5 MHZ to 890 MHZ with minimum return loss of 25 dB at UHF and 30 dB across the VHF band.
5. Directional Coupler Tap, Flush Mounted: Directional coupler type taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. The taps shall be available in isolation values of 3, 8, 12, 16, 20, and 24 dB. Frequency response through any port shall be from 5 MHZ to 890 MHZ.
6. The directional coupler taps shall provide a single RF outlet with a type "F" connector. A through match shall be 18 dB minimum and back match shall be in excess of 14 dB. Any combination of taps shall provide a minimum isolation between tap ports of 30 dB. Through connection to the tap shall be made by standard type "F" fittings. The tap shall be housed in a rugged cast aluminum case and shall be above first floor lay-in ceilings.
7. Directional Coupler Multi-Tap, Surface Mounted: Eight-way directional couple-type taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. All connections to the unit shall be by standard type "F" connectors. The taps shall be available in isolation value of 20 dB.
8. The frequency response shall be from 12 MHZ to 890 MHZ and the return loss at any port shall be no less than 14 dB. Isolation between any two tap outlets shall be no less than 30 dB from 5 MHZ to 400 MHZ and no less than 15 dB from 470 MHZ to 806 MHZ.
9. The tap shall be housed in a rugged cast aluminum housing provided with flanges to permit mounting on any flat surface.

2.2 CABLE SUPPORTS

A. Manufacturers:
1. J-Hooks: *Caddy*, *Chatsworth*, or *Mono-System*.
2. Cable Ties: *DEK*, *Panduit*, *AMP*, *3M*, or *T&B*.

B. J-Hooks shall be sized to correctly support the number of cables which pass through them. Under no circumstances shall cable quantity exceed 14 in any given support. J-Hooks shall have a maximum of 40% fill capacity.

C. Cable ties shall be correctly sized to support the quantity and types of cables installed.

2.3 VIDEO OUTLET BOXES

A. Outlet Boxes: Sheet metal or plastic as specified in Section 26 05 33.

2.4 VIDEO OUTLETS

A. Manufacturers:
1. *Leviton* model Quickport Series
2. *AMP*
3. *Hubbell*
4. Substitutions: Or Approved Equal.

B. Recessed Single Outlet Wall Type: "F" style threaded coaxial cable connector suitable for back wiring and mounting in a standard electrical box. Jack shall include a plastic ivory faceplate and mounting lugs.

C. Outlet Combined With Network Jacks: "F" style threaded coaxial cable connector to be included in multi-gang faceplate as specified under Section 27 10 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on Drawings.

C. Beginning of installation means installer accepts existing conditions.

3.2 VIDEO OUTLETS

A. Provide video outlet boxes and jacks as shown on Drawings.

B. Provide recessed (flush) mounted video outlet boxes in all finished areas.

C. Do not install recessed video outlet boxes back-to-back in walls; provide minimum 6-inch separation. Provide minimum 24 inches separation in acoustic rated and fire rated walls.

D. Secure recessed video outlet boxes to interior wall and partition studs. Accurately position to allow for surface finish thickness.

E. Install video outlet boxes at height indicated on Drawings.

F. Adjust video outlet jacks and wall plates to be flush and level.

3.3 VIDEO WIRING

A. Route interior cable concealed in partitions above ceilings. Route video cables within conduit. Exposed wiring may be provided only in the telecommunications closet or unfinished attics.

B. Do not make splices of video cables.

C. Provide video cables continuous from outlet jacks to cable taps and service point.

END OF SECTION 27 15 00.23

SECTION 28 00 00

GENERAL ELECTRONIC SAFETY AND SECURITY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish all materials, labor, tools, transportation, incidentals, and appurtenances to complete in every detail and leave in working order all items of work called for herein or shown on the accompanying drawings, including work related to:
   1. Fire alarm system including control panels, initiating devices, notification devices, and all associated wiring as specified under Section 28 31 13.
   2. Fire alarm municipal reporting master box and communications cable as specified under Section 28 31 13.
   3. Door entry access control system including door entry panel, living unit intercom stations, living unit strobes, and all associated wiring as specified under Section 28 13 00.

B. Include any minor items of work necessary to provide a complete and fully operative electrical systems.

C. The Contractor for this work is referred to Bidding Requirements, General Conditions, Special Conditions, Temporary Services and other pertinent Sections of these Specifications. These sections describe work that is a part of this Contract as contained in Division 01. The following General Provisions amplify and supplement these Sections of Specifications. In cases of conflicting requirements, the stipulations set forth in Division 01 supersede and must be satisfied by the Contractor.

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

B. Section 27 10 00 – Structured Cabling System.

C. Section 28 13 00 – Door Entry Access Control System.

D. Section 28 31 13 – Fire Alarm System.

1.3 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. ANSI/NFPA 72 - National Fire Code.

C. ANSI/NFPA 101 - Life Safety Code.

D. OSHA 1910 - Occupational Safety and Health Act.

E. ADA - Americans with Disabilities Act.

1.4 GENERAL REQUIREMENTS

A. Contractor shall read the entire specifications covering other branches of work. He is responsible for coordination of his work with work performed by other trades.

B. Consult all Contract drawings which may affect the location of any equipment or apparatus furnished under this work and make minor adjustments in location as necessary to secure coordination. Contractor shall consult architectural interior elevations for mounting heights of fire alarm devices.

C. System layout is schematic and exact locations shall be determined by structural and other conditions. This shall not be construed to mean that the design of the system may be arbitrarily changed. The equipment layout is to fit into the building as constructed and to coordinate with equipment included under other Divisions of work.

D. Contractor shall contact the Owner's Representative immediately if he notices any discrepancies or omissions in either the drawings or the specifications, or if there are any questions regarding the meaning or intent thereof.

E. Submit all changes, other than minor adjustments, to the Architect for approval before proceeding with the work.

1.5 SUBMITTALS

A. Submit under provisions of the following and Division 01.

B. Submittal shall include complete Specifications, including type of materials, electrical characteristics, capacities, performance and power requirements to determine compliance with Contract Documents. All data submitted shall be complete and shall apply only to this specific project. All extraneous material shall be deleted or marked out. Items to be supplied shall be specifically indicated using a method that will be visible after photocopying.

C. Regardless of any information included in the submittal submitted for review, the requirements of the Drawings and Specifications shall not be superseded in any way by the review. Review by the Architect-Engineer does not relieve responsibility for submittal errors or from meeting the requirements of the Contract Documents.

D. It is intended that Submittal data be complete and accurate at the first submission. If the Submittal is returned marked "Resubmit" only one additional submission will be permitted.

E. Submit related Submittal at one time. SUBMIT ALL ITEMS IN A SPECIFICATION SECTION AT THE SAME TIME. Incomplete submittal will be held until a complete submittal is accumulated or may be rejected without further review and returned to the applicable parties. Include a copy of the Specification Paragraphs pertaining to the items submitted.

F. If proposed equipment deviates from the Specifications or Drawings, indicate in writing on Company letterhead those differences and provide sufficient data to justify acceptance. FAILURE TO INDICATE DEVIATIONS OR SUBSTITUTIONS IMPLIES FULL

COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

G. The term "by others" or similar wording shall not be used on Submittal. Submittal shall state by whom related items of work are to be provided. Where not indicated, it is implied that the work or item is provided under this Section.

H. Shop Drawings: Provide shop drawings as required by the individual Specification Sections. Submit shop drawings indicating physical size and arrangement, (plans and elevations) construction details, provisions for conduits, access requirements for installation and maintenance, finishes, and materials used in fabrication for all equipment. Supplement shop drawings with wiring diagrams for all systems with wiring connections for multiple components.

I. Submittals shall be made as paper copies. Submittals transmitted only by electronic email shall not be accepted.

1.6 REGULATORY REQUIREMENTS

A. Complete installation shall conform with all applicable Federal, State and Local laws, Codes and Ordinances, included but not limited to latest approved editions of the following:
1. State Building Codes.
2. Specific Construction Safety Requirements, State Industrial Commission.
3. National Electrical Code - NFPA 70.
4. National Fire Code - NFPA 72.
5. Life Safety Code - NFPA 101.
6. Occupational Safety and Health Act (OSHA) of 1971 and all amendments thereto.
7. ADA - Handicap Accessibility Requirements.
8. Maine State Elevator Code.

B. Nothing contained in the drawings and specifications shall be construed to conflict with these laws, codes and ordinances, and they are thereby included in these specifications. All work shall comply with the 2008 edition of NFPA 70, The National Electrical Code, and with the 2007 edition of NFPA 72, The National Fire Alarm Code. It shall be the Contractor’s responsibility to assure that all work is in full compliance with applicable codes.

C. The Contractor shall visit the site to become familiar with all existing conditions affecting this work. No claim will be recognized for extra compensation due to failure of contractor to familiarize himself/herself with the conditions and extent of proposed work.

D. Obtain and pay for all necessary permits. Request inspections from authority having jurisdiction.

1.7 RECORD DRAWINGS

A. Record any changes in location of equipment items, system devices, and similar construction items on a set of prints and deliver them to the Owner’s Representative upon completion of the work.

1.8 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Provide a Complete Instruction and Maintenance Manual: Prepare in the form of an instructional manual for use by Owner's personnel. Provide one (1) draft copy and two (2) final copies.
   1. Format:
      a. Size: 8-1/2" x 11", 20 lb. minimum weight white paper for typed pages, either manufacturer's printed data, or neatly typewritten.
      b. Drawings: Provide reinforced punched binder tab, bind in with text. Fold larger drawings to size of text pages. Clear plastic "binding tape" (not "Scotch" tape) applied to edge of sheet and then punched is acceptable.
      c. Single-sheet product literature and contractor-prepared pages: Provide reinforced punched binder tab. Clear plastic "binding tape" (not "Scotch" tape) applied to edge of page and then punched is acceptable.
      d. Provide indexed tabs and flyleaf for each separate product, or each piece of operating equipment. Include typed description of product, and major component parts of equipment.
      e. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".
      f. Binders:
         1) Commercial quality three-ring binders with durable and cleanable plastic covers, 1" minimum, 2" maximum ring size.
         2) When multiple binders are used, collate the data into related consistent groupings and provide a spine label that includes the volume number and contents of the binder.

B. Provide content as listed in separate Sections of Division 28 of these specifications.

1.9 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.10 COORDINATION WITH WORK PROVIDED UNDER DIVISION 26

A. Telecommunications work shall be coordinated with associated work being provided under Division 26. Work provided under Division 26 shall include the following:
   1. Raceway and Boxes for wiring.
   2. 120-volt power circuits.

1.11 COORDINATION WITH WORK PROVIDED UNDER OTHER DIVISIONS

A. Division 14 - Elevator: Provide all necessary fire alarm connections to the elevator as required by the elevator supplier/installer. All work shall conform to the State Elevator Code. Provide all necessary components and wiring connections for full conformance with the Elevator Code.

B. Division 27 - Telecommunications: Provide telephone wiring and connections to the fire alarm control panel as specified under Section 27 10 00.

1.12 COORDINATION WITH OWNER FURNISHED ITEMS

A. Provide all necessary wiring to support the door entry access control system as specified under Section 28 13 00.

1.13 UTILITY SERVICE WORK

A. The Contractor shall arrange with the City of Portland Fire Department for connection to the overhead municipal fire alarm system lines at Crescent Street. Work shall include the following:
   1. Fire alarm communications cable as specified under Section 28 31 13.

B. Conduit for fire alarm cable shall be provided Division 26.

1.14 SUBSTANTIAL AND FINAL COMPLETION

A. Refer to General Conditions and Supplementary Conditions.

B. Substantial Completion shall not be considered unless all systems are tested and verified for adherence with Contract Documents and any work remaining is less than one percent of the total Contract Value of this Section.
   1. Record Drawings, Operation and Maintenance Manuals, Acceptance Demonstrations, Owner personnel training, spare parts or extra materials required, test reports, warranties and certifications of installation inspections shall be submitted and accepted prior to Substantial Completion.

C. Final Completion shall be when all work under this Section is completed as defined by the Contract Documents and accepted by the Architect-Engineer.

D. When Architect-Engineer determines Work is complete, close out submittals will be considered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish new and undeteriorated materials and of a quality not less than what is specified.

B. The selection of materials and equipment to be furnished shall be governed by the following:
   1. Where single trade name, brand of manufacturer or material is listed in the specification, the exact equipment listed shall be used in the bid.
   2. Where more than one name is listed, Contractor may select any one of the several brands specified.
   3. Where trade name, brand of manufacturer of equipment or material is listed in the specification followed by the word “or approved equal,” the Contractor may substitute product of equal quality from another manufacturer for consideration by the Engineer.

C. Conduit shall be as specified under Section 26 05 33.

PART 3 - EXECUTION

3.1 PROTECTION AND CLEANING

A. Protect all electrical work and products against damage during construction and pay the cost of repair or replacement of electrical products made necessary by failure to provide suitable safeguards or protection.

B. After all work has been inspected and approved, thoroughly clean all equipment, provided under this work.

END OF SECTION 28 00 00

SECTION 28 13 00

DOOR ENTRY ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Combination paging intercom and door control system.

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

B. Section 26 05 19 – Low Voltage Electrical Power Conductors.

1.3 REGULATORY REQUIREMENTS

A. System: UL listed.

1.4 SYSTEM DESCRIPTION

A. Intercom Door Control: A door entry access control system shall be provided to facilitate voice paging between the main entrance and the individual living units. In addition, the entrance door lock at the entrance vestibule shall be remotely controlled by local intercom stations in individual living units.

1.5 SUBMITTALS

A. Provide wiring diagrams, data sheets, and equipment ratings, layout, dimensions, and finishes.

1.6 PROJECT RECORD DRAWINGS

A. Include location of system devices.

1.7 OPERATION AND MAINTENANCE DATA

A. Include operating instructions, and maintenance and repair procedures.

PART 2 - PRODUCTS

2.1 INTERCOM/ DOOR CONTROL COMPONENTS

A. Manufacturers:
   1. *TekTone*.
   2. Substitutions: Or Approved Equal.

B. Master Intercom/Door Control Stations:
   1. *TekTone* Model # CM492/012/OF192/OH190
   2. Mounting: Recessed wall
   3. Station capacity: 12 units

4. Directory: Model # AM190D.
5. Communications: Integral speaker and microphone.
6. Size: 16.5" H x 4" W

C. System Amplifier:
1. *TekTone* Model # PK543A
2. Mounting: Surface wall.
3. Delay Timing: Selectable 10 or 20 seconds.
4. Size: 5.5" H x 3.125" W x 2" D
5. Power: 16 VAC, 10 VA

D. Transfer Relay:
1. *TekTone* Model # PK543B
2. Mounting: Surface mount.

E. Transformer:
1. *TekTone* Model # SS102A
2. Primary: 120 VAC
3. Secondary: 16 VAC
4. Connection: Hard wired.

F. Living Unit Intercom Station:
1. *TekTone* Model # IR105E
2. Mounting: Recessed wall.
3. Communications: Integral speaker and microphone with call button.
4. Size: 6.875"H x 5" W x 1.25" D.
5. Speaker: 3.25" diameter with voice frequency response.

G. Living Unit Strobe Unit:
1. *TekTone* Model # LI404B
2. Mounting: Flush mount.
3. Size: 6.5" W x 8.5" H.
4. Strobe: Flashes for 15-20 seconds upon receipt of incoming call signal.

H. Wiring: As recommended by the manufacturer.
1. Audio: Two-pair 22AWG, twisted, shielded.
2. Low-Voltage: #18 or #22AWG as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate door entry access control system with door operators and door hardware being provided under the General Contract. Contractor is responsible for coordination of all interface requirements including proper voltages, conductors and terminations.

3.2 INSTALLATION

A. Install devices in accordance with manufacturer's instructions.

B. Verify exact location of living unit intercom stations and living unit strobe units with Architect prior to rough-in.

C. Coordinate mounting height for door entry stations with Architect prior to rough-in.

D. Install system amplifier, transfer relay and power transformer in Electrical Room B09.

3.3 FIELD QUALITY CONTROL

A. Provide field-testing and adjustment of installed security alarm devices to assure satisfactory operation.

END OF SECTION 28 16 00

SECTION 28 31 13

FIRE ALARM AND SMOKE DETECTION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specification includes the furnishing, installation, and connection of a "house" fire alarm system consisting of a microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. This section of the specification also includes furnishing, installation and connection of "local" fire alarm detection/notification means within individual living units. Local fire alarm means shall include, but not be limited to, alarm initiating devices, alarm notification appliances and wiring as shown on the Drawings and specified herein.

C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.

D. This section also requires a connection to the City of Portland municipal fire alarm box system for reporting a "house" alarm condition.

1.2 "HOUSE" FIRE ALARM SCOPE

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:
   1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on an NFPA Style 7 (Class A) Signaling Line Circuit (SLC).
   2. Initiation Device Circuits (IDC) shall be wired Class A (NFPA Style D).
   3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z).
   4. Digitized electronic signals shall employ check digits or multiple polling.

C. A single ground or open on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

D. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

E. Interlock alarm system automatic detectors at the top and bottom of elevator shaft and in the Elevator Machine Room with the elevator power service shunt trip such that an alarm condition at any of these detectors shall automatically disable the elevator electrical service feeder. Provide an interlock between the fire alarm system smoke detectors at the Elevator Lobbies on each floor, and the elevator controller, such that:

1. Alarm activation by either the detector at any upper floor, the Basement Floor, Elevator Lobby, or at the detector in the Elevator Machine Room, shall automatically send the elevator to the First Floor.
2. An alarm condition activated by the First Floor Elevator Lobby smoke detector shall automatically send the elevator car to the Basement Floor.
3. Provide a tamper switch for each sprinkler system valve at all sprinkler lines extended into the elevator shaft.

1.3 "HOUSE" SYSTEM FUNCTIONAL OPERATION

A. When a fire alarm condition is detected and reported by one of the system initiating devices located in common areas, the following functions shall immediately occur:
   1. The system alarm LED shall flash.
   2. A local piezo electric signal in the control panel shall sound.
   3. A backlit 80-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
   4. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
   5. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed and the associated system outputs (alarm Notification appliances and/or relays) shall be activated.
   6. Audible and visual alarm notification appliances throughout the facility (including those in Living Units) shall activate.

1.4 "LOCAL" FIRE ALARM SCOPE

A. Multiple-station, hard-wired unitary equipment conforming to NFPA 72 shall be provided for all living units and shall be installed in accordance with the project specifications and Drawings.

B. Basic Performance:
   1. Handicap Accessible Living Units (all units): Actuation of any automatic fire alarm initiating device causes all audible and visual alarms to activate within the given unit.

1.5 SUBMITTALS

A. General:
   1. Submit shop drawings and product data under provisions of Division 1 and Section 26 00 00.
   2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment (compatible UL Listed) from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
   3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

C. Manuals:
1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications:
1. Provide the services of a factory-trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

E. Certifications: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.6 GUARANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.7 POST CONTRACT MAINTENANCE

A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

1.8 POST CONTRACT EXPANSIONS

A. The contractor shall provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

1.9 APPLICABLE STANDARDS AND SPECIFICATIONS

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards.

1. National Fire Protection Association (NFPA) - USA:
   a. No. 12 — CO2 Extinguishing Systems.
   b. No. 12A & 12B — Halon Extinguishing Systems.
   c. No. 15 — Water Spray Systems.
   d. No. 16 — Foam/Water Deluge and Spray Systems.
   e. No. 72-1993 — National Fire Alarm Code.
   f. No. 101 — Life Safety Code.
2. Underwriters Laboratories Inc. (UL) - USA:
   a. No. 268 — Smoke Detectors for Fire Protective Signaling Systems.
   b. No. 864 — Control Units for Fire Protective Signaling Systems.
   c. No. 268A — Smoke Detectors for Duct Applications.
   d. No. 521 — Heat Detectors for Fire Protective
   e. No. 464 — Audible Signaling Appliances.
   f. No. 38 — Manually Actuated Signaling Boxes.
   g. No. 346 — Waterflow Indicators for Fire Protective Signaling Systems.
   h. No. 1076 — Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
   i. No. 1971 — Visual Notification Appliances.

B. Local and State Building Codes.

C. All requirements of the City of Portland Fire Department.

1.10 APPROVALS

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
   1. UL Underwriters Laboratories Inc.
   2. FM Factory Mutual

B. The fire alarm control panel shall meet UL Standard 864, (Control Units) and UL Standard 1076 (Proprietary Burglar Alarm Systems).

C. The system shall be listed by the national agencies as suitable for extinguishing release applications.

PART 2 - PRODUCTS

2.4 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

C. All Equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.5 CONDUIT AND WIRE

A. Conduit:
1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements, and shall be as specified in Section 16111.
2. Where possible, all wiring shall be concealed within partitions or above ceilings. Where exposed wiring is necessary, it shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduits shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backboxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:
1. All fire alarm system wiring shall be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication loop shall be twisted and shielded and support a minimum wiring distance of 10,000 feet. The system shall support up to 1,000 ft. of untwisted, unshielded wire. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.
6. All field wiring shall be completely supervised.
7. The Fire Alarm Control panel shall be capable of T-Tapping Class B (NFPA Style 4) Signaling Line Circuits (SLC's). Systems that do not allow or have restrictions in, for example, the amount of T-Taps, length of T-Taps etc., are not acceptable.
8. Wire for connection to the City’s municipal fire alarm system shall be 2/C #16 twisted, shielded pair. Coordinate the purchase of this cable with the City Fire Department prior to purchase.

C. Terminal Boxes, Junction Boxes and Cabinets: All boxes and cabinets shall be UL listed for their use and purpose.

D. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow). Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

E. The Fire Alarm Control Panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the Main Power Distribution Panel as FIRE ALARM. Fire Alarm Control Panel Primary Power wiring shall be 12 AWG. The Control Panel Cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.6 "HOUSE" FIRE ALARM CONTROL PANEL:

A. The FACP shall be a *Notifier* Model FireWarden-100-2(E), or APPROVED EQUAL and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. System Capacity and General Operation:
1. The control panel shall provide, or be capable of expansion to 198 intelligent/addressable devices.
2. The system shall include Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC. It shall also include four Class B (NFPA Style Y) programmable Notification Appliance Circuits.
3. The system shall support up to 99 programmable EIA-485 driven relays for an overall system capacity of 301 circuits.
4. The Fire Alarm Control Panel shall include a full-featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
6. The FACP shall provide the following features:
    a. Drift Compensation to extend detector accuracy over life.
    b. Sensitivity Test, meeting requirements of NFPA 72, Chapter 5.
    c. Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.
    d. System Status Reports to display or printer.
    e. Alarm Verification, with verification counters.
    f. PAS presignal, meeting NFPA 72 3-8.3 requirements.
    g. Rapid manual station reporting (under 2 seconds).
    h. Non-Alarm points for general (non-fire) control.
    i. Periodic Detector Test, conducted automatically by software.
    j. Pre-alarm for advanced fire warning.
    k. Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
    l. March time and temporal coding options.
    m. Walk Test, with check for two detectors set to same address.
    n. UL 1076 Security Monitor Points.
    o. Control-By-Time for non-fire operations, with holiday schedules.
    p. Day/Night automatic adjustment of detector sensitivity.
    q. Device Blink Control for sleeping areas.
7. The FACP shall be capable of coding Notification circuits in March Time (120 PPM), Temporal (NFPA 72 A.2.2.2.2), and California Code.

C. Central Microprocessor:

1. The Microprocessor shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

D. Display:
1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
3. The display shall provide an 80-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide 5 Light-Emitting-Diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, FIRE ALARM, SYSTEM TROUBLE, ALARM SILENCED, SUPERVISORY, MAINTENANCE/PRE-SIGNAL, DISABLED, BATTERY FAULT, and GROUND FAULT.
4. The Display shall provide a 16-key touch keypad with control capability to command all system functions, entry of alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The Display shall include the following operator functions: ALARM SILENCE, SYSTEM RESET, DRILL, and ACKNOWLEDGE/STEP.

E. Signaling Line Circuit (SLC):
1. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (Ionization, Photoelectric, or Thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. This shall be accomplished over a single SLC loop and shall be capable of NFPA 72 Style 4, Style 6, or Style 7 wiring.
2. The loop interface shall receive analog information from all intelligent detectors that shall be processed to determine whether normal, alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:
1. An EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals shall be provided.
2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.
3. The EIA-232 interface shall include special protocol methods that allow off-site monitoring of the FACP over standard dial-up phone lines. This ancillary capability shall

allow remote readout of all status information, including analog values, and shall not interfere with or degrade FACP operations when used. It shall allow remote FACP Acknowledge, Reset, or Signal Silence in this mode. It shall also allow adjustment of detector sensitivity and readout of the history file.

4. An EIA-485 interface shall be available for the serial connection of remote annunciators and LCD displays.
5. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.

G. Enclosures:
   1. The control panel shall be housed in a UL listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
   2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

H. All interfaces and associated equipment are to be protected so that voltage surges or line transients, consistent with UL standard 864, will not affect them.

I. Optional plug-in modules shall be provided for by NFPA 72, Chapter 4, Transmitters.

J. An optional module shall be available which provides 8 Form-C relays rated at 5.0. The relays shall track programmable software zones.

K. Power Supply:
   1. The Power Supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
   2. It shall provide 5.0 amps of usable Notification appliance power, using a switching 24 VDC regulator. A 3.0 amp Notification expansion power supply shall be available for the demanding requirements of UL 1971 and ADA devices, for a total system capacity of 8 amps.
   3. It shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
   4. It shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
   5. It shall be power-limited per 1995 UL864 standards.
   6. It shall provide optional meters to indicate battery voltage and charging current.

L. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.
   1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60-hour standby.
   2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
   3. The FCPS shall include a surface mount backbox.
   4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1993 NFPA requirements.
   5. The FCPS include power limited circuitry, per 1995 UL standards.

M. Field Wiring Terminal Blocks: For ease of service all panel I/O wiring terminal blocks shall be a removable, plug-in type and have sufficient capacity for 18 to 12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

N. Operator's Controls:
   1. Acknowledge/Step Switch: Activation of the control panel Acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and Trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
      a. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
   2. Alarm Silence Switch: Activation of the Signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field-programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
   3. System Reset Switch: The system reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
      a. Holding the system RESET switch shall perform a lamp test function.
   4. Drill (Evacuate) Switch: The drill switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

O. Field Programming:
   1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
   2. All programming may be accomplished through the standard FACP keypad.
   3. All field-defined programs shall be stored in non-volatile memory.
   4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual on/off commands. A second (higher-level) is used for actual change of program information.
   5. Program edit shall not interfere with normal operation and fire protection. If a fire condition is detected during programming operation, the system shall exit programming and perform fire protection functions as programmed.
   6. A special program check function shall be provided to detect common operator errors.
   7. An Auto-Program (self-learn) function shall be provided to quickly install initial functions and make the system operational.
   8. For flexibility, an off-line programming function, with batch upload/download, shall also be available.

P. Specific System Operations:
   1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all-analog intelligent smoke detectors in the system from the control panel. Sensitivity range shall be within the allowed UL window.
   2. Alarm Verification: Each intelligent addressable smoke detector in the system shall be independently selected and enabled to be alarm verified. The alarm verification delay shall be programmable from 5 to 30 seconds. The FACP shall keep a count of the number

of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

3. Point Disable: Any device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
   a. Device status.
   b. Device types.
   c. Custom device labels.
   d. View analog detector values.
   e. Device zone assignments.
   f. All program Parameters.
5. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing system status.
6. System History Recording and Reporting: The Fire Alarm Control Panel shall contain a History Buffer that will be capable of storing up to 650 system alarms/troubles/operator actions. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the History Buffer may be manually reviewed, one event at a time, or printed in its entirety.
   a. Although the foreground history buffer may be cleared for user convenience, a background, non-erasable buffer shall be maintained which provides the last 650 system events.
   b. The History Buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The Fire Alarm Control Panel shall automatically interrogate each intelligent smoke detector and shall analyze the detector responses over a period of time.
   a. If any intelligent smoke detector in the system responds with a reading that is below or above normal limits, then the system will enter the Trouble Mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. Pre-alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field-adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
9. Software Zones: The FACP shall provide 99 software zones. All addressable devices may be field-programmed to be grouped into software zones for control activation and annunciation purposes.

2.7 “HOUSE” FIRE ALARM COMPONENTS:

A. Programmable Electronic Sounders:
   1. Electronic sounders shall operate on 24 VDC nominal.
   2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, Temporal or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
   3. Shall be flush or surface mounted as shown on plans.

B. Strobe Lights:
   1. Shall operate on 24 VDC nominal.
   2. Shall meet the requirements of the ADA as defined in UL standard 1971 and shall meet the following criteria:
      a. The maximum pulse duration shall be 2/10ths of one second.
      b. The strobe intensity shall meet the requirements of UL 1971.
         (1) Strobe intensities for common spaces shall be as indicated on the plans.
         (2) Strobe intensities for spaces within living units, other than bedrooms, shall be as follows:
            (a) Rooms 20 foot square or less: 15 cd.
            (b) Rooms 30 foot square or less: 30 cd.
         (3) Strobe intensities for bedrooms within living units shall be as follows:
            (a) Top of strobe less than 24" from ceiling: 177 cd.
            (b) Top of strobe equal to or greater than 24" from ceiling: 110 cd.
      c. The flash rate shall meet the requirements of UL 1971.
      d. The appliance shall be placed 80 in (2,030 mm) above the highest floor level within the space, or 6 in (152 mm) below the ceiling, which ever is the lower.

C. Audible/Visual Combination Devices:
   1. Shall meet the applicable requirements of Section A listed above for audibility.
   2. Shall meet the requirements of Section B listed above for visibility.

D. Addressable Devices – General:
   1. Addressable Devices shall provide an address-setting means using rotary decimal switches.
   2. Addressable Devices shall use simple to install and maintain decade (numbered 1 to 10) type address switches. Devices that use a binary address setting method, such as a dipswitch, are not an allowable substitute.
   3. Detectors shall be intelligent and addressable, and shall connect with two wires to the Fire Alarm Control Panel Signaling Line Circuits.
   4. Addressable smoke and thermal detectors shall provide dual alarm and power LEDs. Both LEDs shall flash under normal conditions indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs shall be optional through the system field program. An output connection shall also be provided in the base to connect an external remote alarm LED.
   5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity shall be automatically adjusted by the panel on a time-of-day basis.
   6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
   7. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. An optional base shall be available with a built-in (local) sounder rated at 85 DBA minimum.
   8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).

E. Addressable Pull Box (manual station):
1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches or larger.

F. Intelligent Ionization Smoke Detector: The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

G. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Addressable Dry Contact Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch x 1-1/4 inch x 1/2 inch. This version need not include Style D or an LED.

I. Two-Wire Detector Monitor Module:
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device).
2. The two-wire monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box or with an optional surface backbox.
3. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

J. Addressable Control Module:
1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay.

2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.

K. Isolator Module:
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

L. Waterflow Indicators:
1. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
2. Flow switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30 Ä 45 seconds.
3. Flow switches shall be located a minimum of one (1) foot from a fitting that changes the direction of the flow and a minimum of three (3) feet from a valve.

M. Sprinkler and Standpipe Valve Supervisory Switches:
1. Each sprinkler system water supply control valve riser or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. Each Post Indicator Valve (PIV) or main gate valve shall be equipped with a supervisory switch.
3. Mount switch so as not to interfere with the normal operation of the valve and adjust to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The mechanism shall be contained in a weatherproof aluminum housing that shall provide a 3/4-inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. Switch housing to be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.

7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

2.8 "HOUSE" FIRE ALARM CONTROL PANEL BATTERIES

A. Shall be 12 volt, Gell-Cell type (two required).

B. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.

C. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

2.9 "LOCAL" FIRE ALARM COMPONENTS

A. Living Unit Combination Smoke Detector/Horn/Strobe: *Gentex* Model 7109CS. Wall mounted station with integral photoelectric smoke detector, horn and strobe. Unit shall be equipped with status light and test switch. Provide a quantity of six (6) detectors for future installation by Owner.
   1. Power: 120 VAC with integral 9 VDC battery.
   2. Contacts: Form C
   3. Horn: 90 dB.
   4. Smoke Sensitivity: 3%.
   5. The strobe intensity shall meet the requirements of UL 1971.
      a. Strobe intensities for spaces within living units shall be 177 cd.

2.10 MUNICIPAL FIRE ALARM MASTER BOXES

A. Provide municipal fire alarm master transmittal box as directed by the City Fire Department to match the City's standard.

B. Provide communications cable for fire alarm master box to be run continuously from the master box underground to the riser utility pole at Crescent Street. Provide ten feet of slack cable at the top of the utility riser pole.
   1. Description: IMSA Spec 20-2 shielded, 3-twisted-pair, 600 volt, #16 AWG conductor with black polyethylene jacket. Obtain approval from City Fire Department for cable prior to purchasing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All wiring shall be concealed in finished areas. Exposed wiring in conduit may be used in areas where concealed wiring is not possible; however, prior approval from the Architect must be obtained for any exposed work prior to installation.

C. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3.2 TEST

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.
   1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
   2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
   3. Verify activation of all flow switches.
   4. Open initiating device circuits and verify that the trouble signal actuates.
   5. Open and short signaling line circuits and verify that the trouble signal actuates.
   6. Open and short Notification Appliance Circuits and verify that trouble signal actuates.
   7. Ground all circuits and verify response of trouble signals.
   8. Check presence and audibility of tone at all alarm notification devices.
   9. Check installation, supervision, and operation of all intelligent smoke detectors using the Walk Test.
   10. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
   11. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3 FINAL INSPECTION

A. At the final inspection a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.4 INSTRUCTION

A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The Contractor and/or the Systems Manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 28 31 13

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees shrubs groundcovers plants and grass to remain.
2. Removing existing trees shrubs groundcovers plants and grass.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting and capping or sealing site utilities.
6. Temporary erosion and sedimentation control measures including phasing as may be required by the Erosion Control Plan.
7. Filing appropriate paperwork with the Maine Department of Forestry for clearing operations. (Not required).
8. Survey and flagging of all areas for clearing.
9. Reviewing clearing limits with the Owner and Landscape Architect before commencing clearing operations.

1.2 MATERIAL OWNERSHIP

A. All cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 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 City of Portland Public Services Division.
2. Provide alternate routes around closed or obstructed traffic ways if required by City of Portland Public Services Division.

PART 2 - PRODUCT

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction. Any existing City control monument disturbed during the course of work shall be reset by a State of Maine Licensed Surveyor at no extra cost to the Owner.

B. Locate and clearly flag trees and vegetation to remain or to be relocated.

1. Notify Owner.
2. Walk clearing limit lines with Owner; adjust if requested by Owner or Landscape Architect.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner at no extra cost.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the sediment and erosion control plan for the project

B. Routinely inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Upon satisfactory site stabilization, as determined by the Owner's Representative, remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Landscape Architect.

3.4 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. Interrupting 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.

3.5 CLEARING AND GRUBBING

A. 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 (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 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. All stripped topsoil shall be removed from the site.

3.7 SITE IMPROVEMENTS

A. Remove existing above and below grade site improvements that will not be incorporated into the completed project.

3.8 DISPOSAL

A. Disposal: Remove unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, stumps and cleared material, 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.

END OF SECTION 31 10 00

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for the building slabs-on-grade, walks, pavements, lawns, grasses, and all other subgrade surfaces required for this project.
2. Building pad preparation. The work of this Contract includes the building pad preparation, the excavation, and backfill of foundations, footings, floor slabs, and underslab utilities for the Building.
3. Subbase course for walks and pavements.
4. Subbase and base course for asphalt paving.
5. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: VACANT

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner's Representative or Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner's Representative or Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
3. All excavation including rock is unclassified.

G. Fill: Soil materials used to raise existing grades.

H. Compacted Structural Fill (CSF): Materials below the building pad and used as foundation backfill.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

M. Zone of Influence (ZOI): The area below footings and below imaginary lines that extend 2 ft laterally beyond the footing outer bottom edges and down on a 1H:1V slope to suitable bearing material.

1.3 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Utility Locator Service: Notify utility locator service for area before beginning earthmoving operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. The onsite fills that will be excavated are not suitable as structural fill and may not be used as structural fill beneath the building areas and as foundation backfill.

B. Satisfactory Soils: The existing fill soils will not meet the gradation specifications for Structural Fill or Subbase materials, but they are generally acceptable for reuse as Common Fill as long as it is free of debris, waste, frozen materials, vegetation and other deleterious matter. The native soil may require moisture conditioning during winter construction or wet weather. In no case should frozen soils be used beneath the building footprint, pavement or sidewalk surfaces.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT or a combination of these groups and satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: MDOT 703.06 Type D.

E. Base Course: MDOT 703.06 Type A or B.

F. Compacted Structural Fill: Compacted structural fill (CSF) placed within the ZOI of footings, beneath building slabs, adjacent to foundations beneath site roadways, hard surfaces, and other areas designated by the Contract Drawings should consist of mineral, bank-run sand, and gravel, free of organic material, snow, ice, or other unsuitable materials and should be well-graded within the following limits:

COMPACTED STRUCTURAL FILL (CSF)	
Sieve Size	**Percent Finer**
4-inch	100
3-inch	90 – 100
1/4-inch	25-90
No. 40	0 – 30
No. 200	0 – 5

CSF should be placed in lifts not exceeded 12 inches in loose measure and compacted using self propelled vibratory equipment. In confined areas, maximum particle size should be reduced to 3 inch maximum loose layer reduced to 9 inches and compaction performed by hand guided equipment. A minimum of four systematic passes of the compaction equipment should be used to compact each lift.

CSF placed on the exterior of the perimeter below grade foundation walls should extend laterally a minimum of 4 ft. beyond the outside edge of the walls. Backfill beyond this limit could consist of common fill (discussed below). The top 12 in. of fill around the exterior of the building should consist of low permeability material used to minimize water infiltration adjacent to the structure. Grading should be designed to promote drainage of surface water away from the structure.

G. Crushed Stone: Crushed stone fill is recommended for use as part of the underdrainage and backdrainage systems. Crushed stone fill should be free of organic material, trash, snow, and ice and should conform to the following gradation requirements:

CRUSHED STONE – MDOT 703.22 TYPE C UNDERDRAIN STONE	
Sieve Size	**Percent Finer**
1-inch	100
3/4-inch	90 – 100
3/8-inch	0 – 75
No. 4	0 – 25
No. 10	0 to 5

Crushed stone should be placed in lift thicknesses not exceed 12 inches in loose measure and compacted using either a vibratory plate compactor or by wheel rolling with construction equipment. Four systematic passes should be used to compact each lift.

H. Common Fill: Common fill should consist of mineral sandy soil, free from organic matter, plastic, metal, wood, ice, snow or other deleterious material and should have the characteristic

that it can be readily placed and compacted. Common fill imported to the site should have a maximum of 80 percent passing the No. 40 sieve and a maximum of 40 percent finer than the No. 200 sieve. The largest particle size for common fill should not exceed 2/3 of the loose lift thickness. Silty common fill soils may require moisture control during placement and compaction. Common fill should be placed in maximum 12 inches thick loose lifts using compaction equipment as described above for CSF.

I. Retaining Wall Backfill: Imported retaining wall backfill should consist of compacted structural fill meeting the gradations specified above.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility.

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 earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing." during earthwork operations.

3.2 EXCAVATION – General: Refer to Section 3.3 to 3.5.

A. Excavation for Structures:

1. Excavate to indicate elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
2. Remove fill material within the ZOI of footings to expose naturally deposited glacial till soils or bedrock.
3. Proof roll exposed granular soils (glacial till) with a minimum of two passes of a self-propelled vibratory roller or heavy hand-guided vibratory plate compactor until firm. Exposed silt/clay soils (marine deposits) will not be proof rolled.

4. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Prevent water from accumulating on soil surfaces to reduce the possibility of soil disturbance.
5. Excavation measurement and pay dimensions shall extend 12" beyond the footing or slab.

3.3 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.4 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following trench width. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.

1. A minimum and pay width of 2'-6" for conduits up to 6" diameter.
2. A minimum of 3'-0" or 4/3 the pipe inside diameter plus 1'-6" for conduits over 18".

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade. Excavate trenches 6 inches (150 mm) deeper than elevation to allow for bedding course.

3.5 SUBGRADE INSPECTION

A. Proof-roll subgrade consisting of granular soils (in-situ fill or glacial till) below the building slabs, and below all proposed hard surfaces with a minimum of four passes of a self-propelled vibratory roller or heavy hand-guided vibratory compactor, until firm. Any soft pockets and areas of excess yielding revealed by proof rolling will be removed and replaced with CSF or Subbase Material. Do not proof-roll wet or saturated subgrades or subgrades consisting of silt/clay soils (marine deposits).

B. The exposed subgrade will be examined in the field by the Geotechnical Engineer to observe the strength and bearing capacity of the soils. Disturbed or soft soils, as judged by the Geotechnical Engineer, shall be excavated and replaced with CSF without additional compensation.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Geotechnical Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by the Geotechnical Engineer.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches within ZOI of footings with CSF or lean concrete fill; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete".

D. Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of select backfill free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities which are non-metallic, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use CSF.
4. Under building slabs and foundations, use CSF for entire required depth of fill.
5. For foundation backfill, use CSF.
6. Retaining walls use Retaining Wall Backfill.

3.10 ROCK FILL – VACANT

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 inches (300 mm) near structures and in loose depth for material compacted by heavy compaction equipment, and not more than 8 inches (200 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, compact each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 92 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus ¼" with no "bird baths".
3. Pavements: Plus or minus ¼" with no "bird baths".

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.14 SUBBASE AND BASE COURSES

A. Place subbase and base course on stable, firm subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.
2. Compact subbase and base course in maximum 8 inch (200 mm) lifts in uncompacted thickness at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.15 DRAINAGE COURSE – VACANT

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work complies with requirements.

C. Footing Subgrade: At footing subgrades consisting of CGF, tests will be performed to verify that the compaction requirements are achieved. Bearing capacities will be verified visually in marine soils and glacial till.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained without additional compensation.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions, without additional compensation.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing, without additional compensation.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 20 00

SECTION 31 23 19

DEWATERING

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes temporary construction dewatering.

1.2. DESCRIPTION OF WORK

A. The work includes but is not limited to providing all labor, materials, equipment and incidentals to:

1. Design, furnish, install, test, operate, monitor, maintain and remove a temporary dewatering system to: (1) lower groundwater levels in soils below the final excavation level, maintain excavation stability, and prevent disturbance to soils below the final excavation level; and (2) collect and remove precipitation, surface water runoff, and construction generated waste waters from excavations in accordance with the requirements specified herein.

2. As required by applicable permits, sample effluent from the temporary dewatering system, conduct laboratory testing, and report the test data to the Owner's Representative and the authority(s) having jurisdiction over the work.

3. Design, furnish, install, maintain, and operate a sediment system to treat groundwater if necessary to comply with permit(s) and discharge criteria, including treatment (if needed) to reduce contaminant concentrations in the dewatering effluent prior to discharge.

1.3. DEFINITIONS AND REFERENCE STANDARDS

A. Engineer: Authorized representatives of the Owner. For the work covered under this Section, this term shall include S. W. Cole Engineering, Inc. and DeLuca-Hoffman Associates, Inc.

B. Contractor: Entity responsible for completing the work of this Section.

1.4. JOB CONDITIONS

A. Subsurface Information: A geotechnical report summarizing subsurface conditions has been prepared for the project by S. W. Cole Engineering, Inc., dated October 24, 2008, and is made part of these documents. Please note that the engineering recommendations included in this report are to be considered "for informational purposes only". The information provided in the contract documents supercedes the recommendations included in this report. The CONTRACTOR shall base their bid on the information provided in the contract documents.

1.5. DESIGN AND PERFORMANCE CRITERIA

A. The Contractor shall be solely responsible for the design, installation, operation, performance, maintenance, and decommissioning of the temporary dewatering system.

B. The Contractor shall design temporary dewatering systems and shall employ measures to protect existing and new site improvements and off-site structures against dewatering-induced impacts.

C. The Contractor shall coordinate with the general contractor for access to the site to begin installation of all components of the dewatering system.

D. The Contractor shall not discharge turbid wastewater from the temporary dewatering system into the existing storm drain system.

E. The final design of dewatering components is the sole responsibility of the Contractor and may include sumps, drainage ditches, well points, wells or some combination of those components to meet the performance criteria outlined herein.

F. Open pumping using sumps or ditches will be prohibited if such activity results in "boil" conditions, pumping of sand or fines, softening or loss of ground, or unstable excavation subgrades and slopes.

G. Means and methods for installing dewatering wells shall be selected by the Contractor. However, use of hollow-stem augers shall not be permitted due to the potential for borehole smearing. If mud rotary drilling methods are used, use of bentonite drilling mud will not be permitted.

H. If dewatering wells are used, the wells shall be constructed such that the annular space between the well screen and the borehole wall is between 3 and 8 in.

I. Dewatering wells, if used, shall be installed with appropriate sand or gravel pack filters and well screens to prevent pumping of sand or fines, and shall be developed in accordance with the reviewed design submittal. At a minimum, the wells shall be developed by pumping and surging, alternately jetting (with water or air) and pumping, or alternative method acceptable to the Engineer, until the water clears visibly and there is no visible evidence of suspended solids, including entrained soils and drilling fluids. Sand content in the water at the conclusion of well development and throughout well operation shall be less than 5 ppm, determined using a Rossum Sand Content Tester or Imhoff cone, averaged based on at least three measurements.

J. Following well development, install pumps, motors and appurtenances, and discharge piping to a header pipe at current grades and begin pumping. A sufficient number of wells, well points, sumps, drainage ditches or some combination of these components shall be installed and operated to dewater the site and achieve the project objectives, depending on the stage of the excavation work.

K. Groundwater levels shall be lowered at least 2 ft below excavation.

L. Modify the dewatering system at no additional cost to the Owner to achieve the requirements of this Section. Modifications may include additional sump pits, drainage trenches, dewatering wells, pumps, observation wells and other elements incidental to dewatering activities.

M. Comply with federal, state, and local codes, ordinances, permits and regulations for disposal of discharge effluent and collected sediment.

N. Locate dewatering system components where they will not prohibit execution of construction activities and permanent structures.

O. Maintain continuous and complete effectiveness of dewatering systems around-the-clock during construction. Provide backup power generation for dewatering system components and devise emergency procedures for maintaining continuous, uninterrupted dewatering operations as necessary.

P. Design and operate the dewatering systems to prevent loss-of-ground by the pumping (removal) of fines from in-situ soils.

Q. Maintain the dewatering system components to address water quality conditions such as hardness, corrosivity and potential for encrustation and bio-fouling by bacterial growth. Maintenance shall include treatment and cleaning of well screens and redevelopment, as necessary, to maintain pumping rates and well efficiency.

R. Maintain total suspended solids (i.e., turbidity), pH, and other contaminants within permit requirements through the use of sedimentation tanks, bag filters (or combination thereof) and pH control systems.

S. If requested by the Engineer, the Contractor shall excavate all unsuitable soils that become disturbed due to inadequate dewatering and replace the unsuitable soils with compacted structural fill, to the satisfaction of the Engineer and at no additional cost to the Owner.

T. Take measures to prevent damage to existing and new improvements (both on- and off-site) during the course of the Work. Repair damage, disruption, or interference to such improvements directly or indirectly caused by the Contractor's dewatering and recharge activities at no additional cost to the Owner.

1.6. SUBMITTALS

A. General

1. The Contractor shall forward submittals to the Engineer a minimum of three weeks prior to any planned work related to the Contractor’s submittals.

2. The time period(s) for submittals are the minimum required by the Engineer to review, comment, and respond to the Contractor. The Engineer may require resubmission(s) for various reasons. The Contractor is responsible for scheduling specified submittals and resubmittals so as to prevent delays in the work.

3. The Contractor’s submittals shall be reviewed and accepted by the Engineer prior to conducting any work.

4. The Contractor’s submittals shall be prepared and stamped by a Professional Engineer registered in the State of Maine, retained by the Contractor. The Contractor’s Professional Engineer shall have a minimum of five years’ experience in the design of temporary construction dewatering and recharge systems similar to those required for this project.

5. The Contractor shall submit the qualifications and experience of the Engineer and the subcontractor or specialty dewatering firm responsible for the design, installation and operation of the dewatering systems.

6. Acceptance of the Contractor's submittals by the Engineer does not relieve the Contractor of the responsibility for the adequacy, safety and performance of the Work.

PART 2 – PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be of suitable size, capacity and type to:

1. Dewater soils below the final excavation level in accordance with the requirements established herein so that the work can be conducted in-the-dry.

2. Collect and remove groundwater, groundwater seepage, precipitation, surface water runoff, and other construction generated waters from the excavation for the purpose of maintaining dry and stable working surfaces.

3. Maintain suspended solids and other contaminants below permit criteria.

4. Pump, store, manage, treat and discharge treated groundwater as necessary.

B. Materials and equipment shall be of appropriate type and maintained in good working order at all times during the course of the Work. Any leaks or spills shall be immediately fixed or cleaned.

PART 3 – EXECUTION

3.1 GENERAL

A. Install dewatering systems in accordance with the requirements herein and approved shop drawings.

B. Furnish, install, operate, maintain, and decommission dewatering systems in accordance with the requirements herein and approved shop drawings.

C. Monitor the quality and quantity of water discharged from the dewatering system in accordance with the requirements herein and reviewed design submittals.

D. Remove and backfill other dewatering elements (such as well points, ditches and sumps) when no longer required using methods acceptable to the Engineer. Backfill any voids resulting from dewatering system removal with cement grout, concrete, or other material as directed by the Engineer to prevent potential loss of ground.

3.2 OFF-SITE DISCHARGE OF EFFLUENT

A. Discharge groundwater to the designated locations in accordance with the reviewed submittals. Notify the Engineer a minimum of seven days prior to any discharge whether to designated on-site or off-site locations. Discharge to the storm drain shall be conducted only after receiving approval from the Engineer.

B. Manage and treat the groundwater to meet the requirements of all applicable regulatory authorities. The Contractor shall comply with the most stringent criteria and requirements set forth by regulatory agencies.

C. The Contractor shall provide notification of the unexpected or non-complying discharge to the permit authority(s), Engineer and Owner. The Contractor shall then adapt and modify the dewatering systems as required to the meet the requirements of all permits. The Contractor shall immediately cease discharging treated groundwater to the storm drains, route the water to on-site storage units and notify the Engineer if one of the conditions outlined below occurs.

1. Discharge of oil or hazardous materials sufficient to cause a sheen is observed.

2. Monitoring data indicate the discharge is not in compliance with permit requirements.

D. The Contractor shall pay for all fines, penalties, and other costs associated with non-compliance of the permit(s) at no additional cost to the Owner. The Contractor shall also pay all storm drain and sewer use fees in connection with off-site discharge.

E. Provide baffled sedimentation tanks (100 gpm capacity), bag filters, and pH control systems (as necessary) in accordance with the requirements herein and approved shop drawings. Provide sampling ports in the system at points prior to and after treatment and pretreatment (as appropriate) that are accessible at all times to obtain samples of the effluent.

F. The Contractor shall arrange for sampling and testing of dewatering effluent, shall report the test data in the required format to the permit authority(s), Engineer and Owner, and shall perform other compliance activities in accordance with all applicable permit requirements.

G. Clean and remove all sediment or other materials discharged from the system that accumulate in the storm drains, sewers or other existing and new improvements both on- and off-site to the satisfaction of the Engineer and the Owner of the improvement(s) at no additional cost to the Owner.

H. The Contractor shall remove from the site and legally dispose of all by-products and spent materials resulting from pretreatment system mobilization and operation.

END OF SECTION 31 23 19

SECTION 31 25 13

EROSION CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary and permanent erosion control systems.

B. Slope Protection Systems.

1.2 RELATED SECTIONS

A. Section 01 70 00.01 – Site Permit Requirements

B. Section 31 10 00 – Site Clearing

C. Section 31 20 00 – Earth Moving

D. Construction Requirements

1.3 ENVIRONMENTAL REQUIREMENTS

A. The Contractor shall protect adjacent properties from erosion and sediment damage throughout the life of the construction contract in accordance with the Erosion and Sediment Control Report prepared for this project.

Prior to grubbing, orange safety fence shall be installed between the limit of grading. Around trees, the safety fence shall be installed at the drip line of the tree. If disturbance of the root system occurs, the Contractor shall have an Arborist or Nurseryman inspect the root system and provide recommendations to preserve the tree. This information shall be included in the logs for the Erosion Control Plan maintained by the Contractor.

B. The General Contractor will be required to designate, by name, a person responsible for implementation of all erosion control measures as required by this specification. Specific responsibilities will include:

1. Assuring and certifying the contractor's construction sequence is in conformance with the specified schedule. In addition, a weekly certification stating compliance, any deviations, and corrective measures shall be filed with the owner by this person.

2. Inspection of the project work site on a weekly basis, with the installation of added erosion control measures in areas which appear vulnerable to erosion. The erosion and sediment measures shown on the contract documents are minimum provisions. Any additional measures required to comply with the permit or intent of the Erosion and Sedimentation Control plan shall be incidental to the contract.

3. Inspection of all erosion control measures and drainage inlets after any significant rainfall. Accumulated silt/sediment should be removed when the depth of sediment reaches 50 percent of the barrier height. Accumulated silt/sediment should be removed from behind silt fencing when the depth of the sediment reaches 6 inches. A significant rainfall shall be defined as over ½ inch of precipitation in any consecutive 24-hour period.

4. Inspect areas for catch of grass. A minimum catch of 75 percent is required prior to removal of erosion control measures.

5. Maintaining precipitation records and monitoring forecast activity.

C. It shall be the responsibility of the Contractor to implement, maintain, monitor and document compliance with the erosion and sediment control plan for the project and to avoid turbid discharges from the site, to avoid fugitive dust emissions, to avoid sediment from leaving the site, or affecting areas outside of the project work limits.

D. The erosion control measures specified are required to be installed in accordance with the details provided with the construction plans and manufacturer's recommendations. The method and details of the installation of these erosion control methods are of vital importance to insure the effectiveness of the erosion control measures. While precipitation amounts cannot be predicted, the Erosion Control Plan is designed to minimize erosion by restricting the amount of the site that can be open at a given time, limiting the period that an area can be open without stabilization, and requiring weather forecasts to be monitored. It is a requirement of the contract documents that these methods be incorporated on the site.

E. Monthly Training: The Contractor and the designated person responsible for erosion control shall conduct monthly training meetings for anyone working on the site work of the project. A log shall be maintained recording the attendance and the topics of discussion. Each meeting shall include a discussion of problems that occurred in the past month, any approved changes to the Erosion Control Plan, the anticipated upcoming four-week schedule, and a general discussion of the plan requirements.

G. Rain Gauge: Vacant

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quick growing grasses for temporary seeding (see seed mixes contained in Erosion and Sedimentation Report and Section 32 92 00).

B. Hay or straw bales.

C. Fencing for siltation control as specified on the plans. Mirafi prefabricated silt fence or approved equal.

D. Curlex blankets by American Excelsior Company or approved equal. Curlex single net except Curlex double net in winter months.

E. Bale stakes shall be a minimum of 4 feet in length and 1" in width.

F. Temporary mulches such as loose hay, straw, netting, wood cellulose or agricultural silage.

G. Fence stakes shall be wood stakes a minimum of 4 feet in length.

H. Stone Sediment Barriers or SiltSacks™, or approved equal for inlet protection.

I. A stone stabilized construction entrance to be constructed of the materials identified on the contract drawings.

J. Riprap for slopes and aprons.

K. Wood mulch.

L. Calcium chloride and water for dust control.

M. DIRTBAG® as outlined on the contract drawings and specified in Section 31.

N. Catch basin inserts. SiltSacks™ or approved equal.

O. Erosion Control Net. American Excelsior Curlex I or II "Net Free" or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review site erosion control plan made part of the contract drawings.

B. Deficiencies or changes in the erosion control plan as it is applied to current conditions will be brought to the attention of the Engineer and Owner and a remedial action prepared and implemented by the Contractor.

3.2 EROSION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Provide catalog cuts and information concerning the erosion control products which will be used for construction for review by the Owner.

B. Place erosion control systems in accordance with the erosion control plan and in accordance with approved installation procedures.

C. This contract limits the surface area of erodible earth material exposed any time by clearing and grubbing, excavation, borrow and embankment operations. The Owner has the authority to direct the Contractor to provide immediate permanent or temporary pollution control measures. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practical time to minimize the need for temporary controls. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and necessary to comply with the erosion control plan.

D. The temporary erosion control systems installed by the Contractor shall be maintained to control siltation at all times during the life of the Contract. The Contractor must respond to any maintenance or additional work to comply with this specification within a 48-hour period.

E. DIRTBAGS® are required for the discharge of any construction dewatering or pumping, and the DIRTBAG® shall be operational before any trenching.

3.3 CONSTRUCTION OF TEMPORARY EROSION CONTROL MEASURES

A. Level Spreader Construction

1. Ensure that the lip is level to uniformly spread discharge.
2. The lip shall be constructed on undisturbed soil not fill.
3. A 20 foot transition section will be constructed from the diversion channel to the spreader to smoothly blend the different dimension and grades.
4. The runoff discharge will be outletted onto a stabilized vegetated slope not exceeding 10%.
5. Seed and mulch the disturbed area immediately after construction.

B. Silt Fence Construction

1. Woven wire fence to be fastened securely to fence posts with wire ties or staples. Posts shall be steel either 'T' or 'U' type or hardwood.
2. Filter cloth to be fastened securely to woven wire fence with ties spaced every 24" at top and mid section. Fence shall be woven wire, 12 ½ gauge, 6" maximum mesh opening.
3. When two sections of filter cloth adjoin each other they shall be overlapped by six inches and folded. Filter cloth shall be either Filter X, Mirafi 100X, Stabilinka T140N, or approved equivalent.
4. Prefabricated units shall be Geofab, EnviroFence, or approved equivalent.
5. Maintenance shall be performed as needed and material removed when 'bulges' develop in the silt fence.

C. Stabilized Construction Entrance

1. Stone Size – Use 2" stone, or reclaimed or recycled concrete equivalent.
2. Length – Not less than 50 feet (except on a single residence lot where a 30 foot minimum length would apply).
3. Thickness – Not less than six (6) inches.
4. Width – Twelve (12) foot minimum, but not less than the full width at points where ingress or egress occurs. Twenty-four (24) foot if single entrance to site.
5. Filter Cloth – Will be placed over the entire area prior to placing of stone.

6. Surface Water – All surface water flowing or diverted toward construction entrances shall be piped across the entrance. If piping is impractical, a mountable berm with 5:1 slopes will be permitted.
7. Maintenance – The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way, all sediment spilled, dropped, washed or tracted onto public rights-of-way must be removed immediately.
8. When washing is required, it shall be done on an area stabilized with stone and which drains into an approved sediment trapping device.
9. Periodic inspection and needed maintenance shall be provided after each rain.

D. Mulch Anchoring Requirements:

Anchoring Method or Material	**Kind of Mulch to be Anchored**	**How to Apply**
1. Peg and Twine	Hay or straw	After mulching, divid areas into blocks approximately 1 sq. yd. in size. Drive 4-6 pegs per block to within 2" to 3" of soil surface. Secure mulch to surface by stretching twine between pegs in criss-cross pattern on each block. Secure twine around each peg with 2 or more tight turns. Drive pegs flush with soil. Driving stakes into ground tightens the twine.
2. Mulch Netting	Hay or straw	Staple the light-weight paper, jute, wood fiber, or plastic nettings to soil surface according to manufacturer's recommendations. Should be biodegradable. Most products are not suitable for foot traffic.
3. Wood Cellulose Fiber	Hay or Straw	Apply with hydroseeder immediately after mulching. Use 500 lbs. Wood fiber per acre. Some products contain an adhesive material, possible advantageous.
4. Mulch Anchoring Tool	Hay or Straw	Apply mulch and pull a mulch anchoring tool (blunt, straight discs) over mulch as near to the contour as possible. Mulch material should be "tucked" into soil surface about 3".
5. Chemical	Hay or Straw	Apply Terra Tack AR 120 lbs./ac. in 480 gal. of water (#156/ac.) or Aerospray 70 (60 gal/ac.) according to manufacturer's instructions. Avoid application during rain. A 24-hour curing period and a soil temperature higher than 45º Fahrenheit are required.

END OF SECTION 31 25 13

SECTION 31 25 73

DIRTBAG® SPECIFICATIONS FOR CONTROL OF SEDIMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of furnishing, placing and removing the DIRTBAG® pumped sediment control device for erosion-sediment control. The DIRTBAG® pumped-silt control system is marketed by:

ACF Environmental, Inc.
2831 Cardwell Drive
Richmond, Virginia 23234
Phone: 800-448-3636
Fax: 804-743-7779

B. Four DIRTBAGS® shall be included as part of the base bid.

PART 2 - MATERIALS

2.1 DIRTBAG®

A. The DIRTBAG® shall be a non-woven bag which is sewn with a double needle matching using a high strength thread.

B. The DIRTBAG® seams shall have an average wide width strength per ASTM D-4884 as follows.

DIRTBAG® Style	**Test Method**	**Test Result**
DIRTBAG® 53	ASTM D-4884	60 LB/IN
DIRTBAG® 55	ASTM D-4884	100 LB/IN

C. Each standard DIRTBAG® shall be supplied with fill spout large enough to accommodate a 4" discharge hose and straps to secure the hose and prevent pumped water from escaping without being filtered.

D. The geotextile fabric shall be non-woven fabric with the following properties:

Properties	**Test Method**	**Units**	**Non-Woven**	
			53	**55**
Weight	ASTM D-3776	Oz/yd	8	10
Grab Tensile	ASTM D-4632	Lbs.	203	250
Puncture	ASTM D-4833	Lbs.	130	165
Flow Rate	ASTM D-4491	Gal/Min/Ft2	80	70
Permittivity	ASTM D-4491	Sec.^{1}	1.5	1.3
Mullen Burst	ASTM D-3786	Lbs.^{in2}	400	550
UV Resistant	ASTM D-4355	%	70	70
AOS % Retained	ASTM D-4751	%	100	100

All properties are minimum average roll value except the weight of the fabric which is given for information only.

PART 3 – CONSTRUCTION SEQUENCE

3.1 Install DIRTBAG® on a prepared crushed stone pad overlying Mirafi 600X as shown on the contract drawings. Strap the neck of the DIRTBAG® tightly to the discharge hose. The preparation of a DIRTBAG® area is required before any trenching. Any water pumped from the construction site must be discharged through a DIRTBAG®.

3.2 It may be necessary to use hay/poly or other measures to keep the DIRTBAG® from freezing during winter months.

3.3 The DIRTBAG® is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the DIRTBAG®, the type and amount of sediment discharged into the DIRTBAG®, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances, the vendor claims DIRTBAGS® will accommodate flow rates of 1,500 gallons per minute. Use of excessive flow rates or overfilling DIRTBAG® with sediment will cause ruptures of the bags or failure of the hose attachment straps.

3.4 Dispose of DIRTBAG® in accordance with Local, State, and Federal regulations. If allowed, the DIRTBAG® may be cut open and the contents seeded after removing visible fabric. DIRTBAG® is strong enough to be lifted with added straps if it must be hauled away (extra option). Off-site disposal may be facilitated by placing the DIRTBAG® in the back of the dump truck or flatbed prior to use and allowing the water to drain from the bag in place, thereby dismissing the need to lift the DIRTBAG®.

END OF SECTION 31 25 73

SECTION 32 11 00

BASE COURSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Granular Base and Subbase (also referred to as base and subbase aggregates or base and subbase gravels).

1.2 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 32 12 16 - Asphaltic Paving

D. Section 32 16 00 - Curbs and Sidewalks

E. Geotechnical Report

1.3 REFERENCES

A. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lbs (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

C. ASTM D2167 - Test for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

D. ASTM D1556 - Test Method for Density of Soil in-place by the Sand-Cone Method.

E. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth) Method B (Direct Transmission).

F. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

A. Submit materials certificate to on-site independent testing laboratory which is signed by material producer and Contractor, certifying that materials comply with, or exceed, the requirements herein. Materials shall comply with the gradations specified in Section 31 20 00, Earth Moving.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and dry.

3.2 CONSTRUCTION

A. Perform base and subbase course construction in a manner that will drain surface properly at all times and at same time prevent runoff from adjacent areas from draining onto base course or subbase construction.

B. Compact base material to not less than 95% of maximum density as determined by ASTM D-1557 unless otherwise indicated on the Drawings.

C. Granular Subbase: Construct to thickness indicated on Drawings; apply in lifts or layers not exceeding 8", measured loose.

D. Granular Base: Construct to thickness indicated on Drawings. Apply in lifts or layers not exceeding 4" measured loose.

E. All work of this section shall conform to the requirements of Sections 304 of the Maine Department of Transportation Specification for furnishing, placing, and surface tolerance of aggregate base and subbase courses.

3.03 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, retained by the Owner, shall perform construction testing of in-place base courses for compliance with requirements for gradation and density. The Contractor shall retain an independent surveyor to verify paving base course tolerances (by rod and level readings on no more than fifty-foot centers) to +0.05’ of design elevation that allow for paving thickness as shown in the Drawings. Contractor shall provide instruments and a suitable benchmark and perform all survey. The Contractor may, at his option, retain his own test laboratory for quality control, production schedules, or for any other reason at no cost to the Owner.

B. The following tests shall be performed on each type of material used as base and subbase course material:

1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
2. Mechanical Analysis: AASHTO T-88
3. Plasticity Index: ASTM D-4318-84
4. Base and subbase material thickness: Perform one test for each 20,000 square feet in-place base material area.
5. Base and subbase material compaction: Perform one test in each lift for each 20,000 square feet in-place base material area.
6. Test each source of base material for compliance with applicable state highway specifications.

C. Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements:

1. Sand-Cone Method: ASTM D1556
2. Balloon Method: ASTM D2167
3. Nuclear Method: ASTM D2922, Method B (Direct Transmission).

D. Independent Testing Laboratory shall prepare test reports that indicate test location, elevation data, and test results. The Geotechnical Engineer, Owner and Contractor shall be provided with copies of reports within 96 hours of time test was performed. In event that any test performed fails to meet these Specifications, the Owner and Contractor shall be notified immediately by Independent Testing Laboratory. The Owner reserves right to employ a separate testing laboratory and to direct any testing that is deemed by them to be necessary. Contractor shall provide free access to site for testing activities.

E. Any base or subbase courses which become contaminated due to weather, erosion, or other activities, whether or not such contamination is under the control of the Contractor shall be removed and replaced. Said removal and replacement shall be incidental to the work and no additional payment will be made to the Contractor.

END OF SECTION 32 11 00

SECTION 32 12 16

ASPHALTIC PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all material and labor for the placement of surface course and binder course on roads, access drives, parking lots, sidewalks, and walkways. Reference Appendix A for Superpavement requirements which, if used, replace this and MDOT Section 401 in their entirety.

1.2 REFERENCES

A. December 2002 MDOT Standard Specifications, Highways & Bridges, including relevant updates, except as modified herein.

B. December 2002 MDOT Standard Details, Highways & Bridges.

C. MS-2 - Mix design methods for asphalt concrete and other hot mix types - The Asphalt Institute (AI).

D. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).

E. Hot Mix Asphalt Paving Handbook - US Army Corp of Engineers, UN-13 (CE MP-ET).

F. MS-19 - Basic Asphalt Emulsion Manual - The Asphaltic Institute (AI).

G. ASTM D946 - Penetration - Graded Asphalt Cement for use in Pavement Construction.

H. AASHTO M-226/ASTM D3381 Asphalt Cement.

I. AASHTO M-140/ASTM D997 or AASHTO M-208/ASTM D-2397 Tack Coat.

J. AASHTO M-117/ASTM D242 Mineral Filler.

K. AASHTO T-245/ASTM D1559 Marshall Mix Design.

L. Approved and released for construction plans (for State Highway work, there may be a difference between “Released for Bid” and “Approved and Released for Construction” drawings. Any substantive changes shall be addressed by approved change order before commencing the work).

M. City of Portland Technical Standards and Rules and Regulations for Excavation Activities in the Public Right-of-Way.

1.3 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving

B. Section 32 11 00 – Base Courses

C. Section 32 16 00 - Curbs and Sidewalks

D. Section 32 17 23.13 – Painted Pavement Markings

1.4 SUBMITTALS

A. Design Mix: Before any asphaltic concrete paving is constructed, the Contractor shall submit the proposed actual design mix to the Owner for review and/or approval. Design mix submittal shall follow the format as indicated in the Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include the type/name of the mix, gradation analysis, asphalt cement grade used, Marshall Stability (lbs), flow, effective asphalt content (percent), and direct references to the applicable highway department specifications sections for each material. Design shall be for a mixture listed in the most recent edition of roadway specifications of the state in which the project is to be constructed. In no case shall a mix design over three years old be submitted.

B. Material Certificates: Submit materials certificate to an independent testing laboratory retained by the Owner. The certificates shall be signed by the material producer and contractor, certifying that materials comply with, or exceed, the requirements herein.

C. Field density test results, minimum 1 per 100 tons of bituminous pavement placed including sta/offset of test.

D. Plant inspection reports to verify pavement batch plant and paving equipment meets or exceeds MDOT Specification 401. The inspections shall be conducted by an independent testing firm retained by the Owner.

E. LEED Documentation Submittals: Provide the following documentation to the Owner of Record. Refer to and utilize the project LEED Letter Templates provided by the Owner of Record for the form and content required for:
   1. Credit MR 4: Provide LEED Letter Template and final statement of costs for all recycled content materials.
   2. Credit MR 5: Provide LEED Letter Template and final statement of costs for all regional materials.

1.5 JOB CONDITIONS

A. Weather Limitations:

   1. Apply tack coats when ambient temperature is above 40 degrees F, and when temperature has been above 35 degrees F for 12 hours immediately prior to application.

   2. Construct asphaltic concrete paving when atmospheric temperature is above 40 degrees F base, 50 degrees F surface.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide asphaltic concrete mixture as recommended by local or state paving authorities to suit project conditions. Use locally available materials and gradations which meet State Department of Transportation specifications and exhibit satisfactory record on previous installations.

B. Asphalt Cement: Comply with AASHTO M-226/ASTM D 3381; Table 2 AC-10, AC-20, or AC-30, AR-80, viscosity grade, depending on local mean annual air temperature. (See following chart):

Temperature Condition	**Asphalt Grades**
Cold, mean annual air temperature < 7° C (45° F)	AC-10 85/100 pen.
Warm, mean annual air temperature between 7° C (45° F) and 24° C (75° F)	AC-20 60/70 pen.
Hot, mean annual air temperature > 24° C (57° F)	AC-30

Final acceptance of the proper grade of A.C. shall be made by the Owner's Engineer.

C. Tack Coat: Emulsified asphalt; AASHTO M-140/ASTM D 997 or M 208/ASTM D 2397, SS-1h, CSS-1, or CSS-1h, diluted with one part water to one part emulsified asphalt.

D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with AASHTO M-17/ASTM D242, if recommended by applicable state highway standards.

E. Asphalt-Aggregate Mixture: Unless otherwise noted on the Drawings, the Design Mix shall have a minimum stability based on a 50-blow Marshall complying with ASTM D 1559 of 1000 lbs. with a flow between 8 and 16. The Design Mix shall be within sieve analysis and bitumen ranges below:

SIEVE ANALYSIS OF MIX

Square Sieve	**Total Percent Passing**	**Percent Tolerance**
3/4"	100	
1/2"	80-100%	5%
3/8"	65-93%	4%
#8	40-55%	4%
#50	12-27%	2%
#200	0-10%	0%

Percent bitumen by weight of total mix: 5.0 - 8.5.
Air voids: 3-6%
Percent aggregate voids filled with asphalt cement: 70-82%
Allowable variance of percent bitumen by weight of total mix=0.4

2.2 EQUIPMENT

Maintain all batch plant and paving equipment in satisfactory operating condition and correct breakdowns in a manner that will not delay or be detrimental to progress of paving operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove loose material from compacted base material surface immediately before applying prime coat.

B. Proof roll prepared base material surface to check for areas requiring additional compaction and areas requiring removal and recompaction.

C. Do not begin paving work until deficient base material areas have been corrected and are ready to receive paving.

3.2 APPLICATIONS

A. Tack Coat:

1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat on the surface of all such bases where asphaltic concrete paving will be constructed.

3. Apply emulsified asphalt tack coat in accordance with APWA Section 2204 and applicable state highway specifications.

4. Apply at minimum rate of 0.05 gallon per square yard of surface.

5. Allow to dry until at proper condition to receive paving.

3.3 ASPHALTIC CONCRETE PLACEMENT

A. Place asphalt concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum temperatures:

1. When ambient temperature is between 40 degrees F and 50 degrees F: 285 degrees F.
2. When ambient temperature is between 50 degrees F and 60 degrees F: 280 degrees F.
3. When ambient temperature is higher than 60 degrees F: 275 degrees F.

B. Whenever possible, all pavement shall be spread by a finishing machine. Inaccessible or irregular areas, pavement may be placed by hand methods. The hot mixture shall be spread uniformly to the required depth with hot shovels and rakes. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading shall be of the type designed for use on asphalt mixtures. Loads shall not be dumped faster than they can be properly spread. Workers shall not stand on the loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with the surface course placed in the direction of surface-water flow. Place in typical strips not less than 10'-0" wide.

D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

3.4 WEATHER AND SEASONAL LIMITATIONS

For weather limitations the State of Maine will be considered to be divided into two paving zones:

(a) Zone 1: All area north of US Route 2 from Gilead to Brewer and north of Route 9 from Brewer to Calais.

(b) Zone 2: All area south of Zone 1 including the US Route 2 and Route 9 boundaries.

Bituminous plant mix for use other than traveled way wearing course may be placed 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 35 degrees F or higher and the area to be paved is not frozen. Plant mix to be placed as traveled way wearing course may be placed 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 above is 50 degrees F or higher.

Any hot bituminous base or binder course that is to be subject to traffic during the winter months shall have its gradation densified or asphalt content (percent of mix) adjusted through a change in the job mix formula as submitted by the Contractor and approved by the Owner.

3.5 ROLLING AND COMPACTION

A. The mixture, after being spread, shall be thoroughly compacted by rolling as soon as it will bear the weight of the rollers without undue displacement. Mixture shall be compacted to a minimum, of 92% theoretical maximum density. The number, weight, and types of rollers and sequences of

rolling operations shall be such that the required density and surface are consistently attained while the mixture is in a workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 FIELD QUALITY CONTROL

A. An Independent Testing Laboratory, shall be retained to perform construction testing of in-place asphaltic concrete courses for compliance with requirements for thickness, density, composition and surface smoothness. Asphaltic surface and asphaltic base/binder courses shall be randomly cored at a minimum rate of one core for every 20,000 square feet of paving. In no event shall less than three cores in light duty areas and three cores in heavy duty areas shall be obtained. Coring holes shall be immediately filled with full-depth asphalt or with concrete. Asphaltic Concrete pavement samples shall be tested for conformance with the mix design. Refer to the general contract conditions for clarification on the cost for the independent laboratory.

B. Grade Control: Establish and maintain required lines and elevations.

C. Thickness: In-place compacted thickness shall not be less than thickness specified on the drawings. Areas of deficient paving thickness shall receive a tack coat and a minimum 1" overlay; or shall be removed and replaced to the proper thickness, at the discretion of the Owner's; until specified thickness of the course is met or exceeded at no additional expense to the Owner.

D. Surface Smoothness: Testing shall be performed on the finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The results of these tests shall be made available to the owner upon request. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface:	1/4"
Wearing Course Surface:	3/16"

E. Check surface areas at intervals necessary to eliminate ponding areas. Remove and replace unacceptable paving as directed by Owner.

F. Compaction: Field density tests for in-place materials shall be performed by examination of field cores in accordance with one of the following standards:

1. Bulk specific gravity of paraffin-coated specimens: ASTM D-1188.

2. Bulk specific gravity using saturated surface-dry specimens: ASTM D-2726.

Rate of testing shall be one core per 20,000 square feet of pavement, with a minimum of 3 cores from heavy-duty areas and 3 cores from standard-duty areas. Cores shall be cut from areas representative of the project.

Areas of insufficient compaction shall be delineated, removed, and replaced in compliance with the specifications at no expense to the Owner.

G. Pavement Plant Inspection: The paving plant shall be inspected a minimum of one week prior to pavement placement to verify the plant meets the requirements outlined in Section 401. Random inspection and sampling during pavement placement shall be conducted and documented by a testing firm hired and paid for by the Owner.

H. After the binder pavement is placed, the Contractor shall retain an independent surveyor to profile the centerline of the access drive at a minimum of 25-foot stations plus survey the elevations at the locations of any pavement spot grades shown on the drawing and all catch basin inlets. This survey information shall be plotted on the drawing access drive profile and a grading plan. The Contractor shall supply this information in triplicate to the Engineer with copies to the Owner, Owner and Construction Manager. A narrative identifying any areas which do not meet the specification tolerances of subsection E of this specification with an outline of corrective measures shall accompany the submission. The Owner shall have four working days upon certified receipt of these data to issue a letter authorizing surface pavement to be placed.

END OF SECTION 32 12 16

APPENDIX A
SECTION 401

HOT MIX ASPHALT PAVEMENT

Section 401 of MDOT Standard Specifications and the preceding Asphaltic Concrete section are deleted in their entirety and replaced by the following:

401.01 Description. The Contractor shall furnish and place one or more courses of Superpave Hot Mix Asphalt Pavement (SHMA) 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 or established. The Owner will accept this Work under Quality Assurance (QA) provisions, in accordance with these specifications and the requirements of Section 106.

For the purposes of this Section, the Owner shall be defined as the developer or their assigned agent in charge of construction supervision and inspection.

MATERIALS

401.02 Composition of Mixtures. The Contractor shall compose the Hot Mix Asphalt Pavement with aggregate, Performance Graded Asphalt Binder (PGAB), and mineral filler if required. SHMA 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 in any base, binder or shim course, and in any wearing course placed on shoulders (excluding Urban areas).

The Contractor shall submit a JMF for approval. A JMF shall be submitted for testing to a laboratory selected by the Owner for each mixture to be supplied at least 15 calendar days prior to production. The JMF shall establish a single percentage of aggregate passing each required sieve size within the limits shown in Table 1, and shall not cross the restricted zone. The general composition limits given in Table 1 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 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.

In addition, the Contractor shall provide the following information in the proposed JMF.

Superpave Stockpile Gradation Summary
Superpave Design Aggregate Structure Consensus Property Summary
Superpave Design Aggregate Structure Trial Blend Gradation Plots
Superpave Trial Blend Results (summary)
PGAB Specific Gravity and temperature/viscosity charts and Recommended mixing and compaction temperatures from supplier
Material Safety Data Sheets (MSDS) for PGAB

Table 1: COMPOSITION OF MIXTURES – CONTROL POINTS

	GRADING			
	TYPE 25 mm	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm
SIEVE SIZE	PERCENT BY WEIGHT PASSING – COMBINED AGGREGATE			
37.5 mm	100			
25 mm	90-100	100		
19 mm	-90	90-100	100	
12.5 mm	-	-90	90-100	100
9.5 mm	-	-	-90	90-100
4.75 mm	-	-	-	-90
2.36 mm	15-41	23-49	28-58	32-67
1.18 mm	-	-	-	-
0.60 mm	-	-	-	-
0.30 mm	-	-	-	-
0.075 mm	1-7	2-8	2-10	2-10

	RESTRICTED ZONES			
	TYPE 25 mm	TYPE 19 mm	TYPE 12.5 mm	TYPE 9.5 mm
SIEVE SIZE	PERCENT BY WEIGHT PASSING – COMBINED AGGREGATE			
37.5 mm	-	-	-	-
25 mm	-	-	-	-
19 mm	-	-	-	-
12.5 mm	-	-	-	-
9.5 mm	-	-	-	-
4.75 mm	39.5	-	-	-
2.36 mm	26.8-30.8	34.6	39.1	47.2
1.18 mm	18.1-24.1	22.3-28.3	25.6-31.6	31.6-37.6
0.60 mm	13.6-17.6	16.7-20.7	19.1-23.1	23.5-27.5
0.30 mm	11.4	13.7	15.5	18.7
0.075 mm	-	-	-	-

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 shall obtain samples for laboratory testing. The Contractor shall also make available to the Owner 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. Prior to the start of paving, the Contractor and the Owner shall split a production sample for evaluation. The Contractor shall test its split of the sample and determine if the results meet the requirements of the MDOT's written policy for mix design verification (Available at the Central Lab in Bangor). If the results are found to be acceptable, the Contractor will forward their results to the Owner's laboratory, which will test the Owner's split of the sample. The results of the two split samples will be compared and shared between the Owner and the Contractor. If the Owner finds the mixture acceptable, an approved JMF will be forwarded to the Contractor and paving may commence.

The Contractor shall submit a new JMF for approval each time a change in aggregate source, a significant change in proportions, or a change in PGAB is proposed. The same approval process shall be followed.

TABLE 2 – SUPERPAVE Volumetric Design Criteria

Estimated Traffic, million 80 kN ESALs	%G @$N_{initial}$	Voids in the Mineral Aggregate (VMA)					Voids Filled With Binder (VFB)		Fines to Effective Binder Ratio ($P_{0.075}/P_{be}$)	
		9.5 mm	12.5 mm	19.0 mm	25.0 mm	37.5 mm				
		Minimum					Min.	Max.	Min.	Max.
<0.3	<91.5	15.0%	14.0%	13.0%	12.0%	11.0%	70	80	0.6	1.2
0.3 to <1.0	<90.5						65	78		
1.0 to <3.0	<89.5						65	78		
3.0 to <10	<89						65	75*		
10 to <30							65	75*		
30 to <100							65	75*		
≥100							65	75*		

*For 9.5 mm nominal maximum aggregate size mixtures, the maximum VFB is 76.

As design criteria, Voids @ N_{des} shall be 4.0%, Voids @ N_{max} shall be ≥ 2.0%

401.03 Aggregates. 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, minus any reclaimed asphalt pavement used, shall have a minimum degradation value of 30 as determined by the Washington State Degradation Test of 1967, or a Micro-Deval value of under 18 as determined by the AASHTO Provisional Standard available from the Owner's Central Lab in Bangor. If the Contractor elects to use the Micro-Deval, it shall be indicated in the proposed JMF.

Aggregates shall also meet the following 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 – SUPERPAVE Aggregate Consensus Properties Criteria

Estimated Traffic, Million 80 kN ESALs	ASTM D 5821 Coarse Aggregate Angularity (Minimum)		AASHTO TP33 Method A Uncompacted Void Content of Fine Aggregate (Minimum)		ASTM D 4791 (8.4) Flat and Elongated Particles (Maximum)	AASHTO T176 Clay Content/ Sand Equivalent (Minimum)
	Depth from Surface					
	<100mm	>100mm	<100mm	>100mm		
<0.3	60/60	60/60	-	-	-	45
0.3 to <1.0	65/60	60/60	40	-	-	45
1.0 to <3.0	75/60	60/60	40	40	10	45
3.0 to <10	85/80	60/60	45	40	10	45
10 to <30	95/90	80/75	45	40	10	45
30 to <100	100/100	95/90	45	45	10	50
≥ 100	100/100	100/100	45	45	10	50

ASTM D 5821 – "85/80" denotes that 85% of the coarse aggregate has one fractured face and 80% has two fractured faces.

AASHTO TP33 – 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).

401.04 – Vacant

401.05 Temperature Requirements. After the JMF is established, the temperatures of the mixture shall conform to the following tolerances:

In the truck at the mixing plant	± 10º C*
At the Paver	± 10º C*

* If noted in the Quality Control Plan, these may be increased or decreased due to extraordinary considerations, but temperature shall in no case vary by more than 15º C.

The JMF and the mix subsequently produced shall meet the requirements of Tables 2 and 3.

401.06 Performance Graded Asphalt Binder. PGAB shall be as specified in Special Provision 403. The PGAB shall meet the applicable requirements of AASHTO Provisional Standard MP1 – Standard Specifications for PGAB, in accordance with Section 702. The Contractor shall provide the Owner with an approved copy of the Quality Control Plan for PGAB in accordance with AASHTO PP-26.

CONSTRUCTION REQUIREMENTS

401.07 Weather and Seasonal Limitations. The State is divided into 2 paving zones as follows:

(a) Zone 1. Areas north of U.S. Route 2 from Gilead to Bangor and north of Route 9 from Bangor to Calais.

(b) Zone 2. Areas south of Zone 1 including the U.S. Route 2 and Route 9 boundaries.

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 2º C 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 10º C or higher. For the purposes of this Subsection, 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 2º C or higher.

401.08 Hot Mix Asphalt Plant.

401.081 General Requirements. 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.

(a) Truck Scales. When the bituminous mixture is to be weighted on scaled meeting the requirements of Section 109 – Measurement and Payment, the scales shall be inspected and sealed by the State Sealer as often as the Owner deems necessary to verify their accuracy.

(b) 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.

401.083 Automation of Batching. Batch plants shall be automated for weighing, recycling and the monitoring system. In the case of a malfunction of the printing system, the requirements of Subsection 109.013(c) will apply.

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.

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	± 2.5 percent from the cumulative target, each bin
Last Bin Drawn	± 1.5 percent
Mineral Filler	± 0.5 percent
Performance Graded Asphalt Binder	± .25 percent, -.15 percent
Zero Return (aggr.)	± 0.5 percent
Zero Return (bit. Material)	± 0.1 percent

All plants shall be equipped with an approved digital recording device. The delivery slip load ticket shall contain information required under 1 through 4 of Section 109.01(f), and sections (a) and (b) of 109.012.

401.085 Drum Plant Recordation of Proportions. The plant shall utilize an approved recordation system. In the case of a malfunction of this recordation system, the Contractor may continue production for up to two working days while the system is repaired, after which time production shall cease until repairs are completed. The recorder shall simultaneously record the accumulated weights of the dry aggregates, the mineral filler (if added separately) and the Performance Graded Asphalt Binder, all at 5 minute intervals during production and on demand, unless the Owner approves otherwise. The printed record shall include the actual Performance Graded Asphalt Binder content quantity as a percentage of the total mixture weight. The maximum resolution shall be 90 kg of dry aggregate, 9 kg of mineral filler, 9 kg of Performance Graded Asphalt Binder, and 0.1 percent for Performance Graded Asphalt Binder content. The printout shall indicate the amount of moisture programmed into the moisture compensation by total weight. All printed records shall show the day, month, year, and the time to the nearest minute when the printout was generated. The Contractor shall provide the Owner with a clear and legible copy of the recordings at the end of each day.

401.09 Hauling Equipment. 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.

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 above the bed.

401.10 Pavers. Pavers shall be self-contained, self-propelled units with an activated screen (heated if necessary) capable of placing courses of Hot Mix Asphalt Pavement in lane widths on the main line, or shoulder width for shoulders and similar construction.

The Contractor shall place Hot Mix Asphalt Pavement on the main line with a paver using an automatic grade and slope controlled screed, unless otherwise authorized by the Owner. 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, except that a 12 M ski shall be used on Expressway projects.

The Contractor shall operate the paver at speeds which produce a uniform mat. 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.

The Contractor shall have the paver at the project site sufficiently before the start of paving operations to be inspected and approved by the Owner. The Contractor shall repair or replace any paver found worn or defective, either before or during placement, to the satisfaction of the Owner.

401.11 Rollers. 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, unless otherwise authorized by the Owner.
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.

The maximum operating speed for a steel wheel roller shall not exceed the manufacturer's recommendations.

401.111 Surface Tolerances. The Owner will check surface tolerance with a 4.9 m straightedge or string line placed parallel to the centerline of pavement and with a 3 m straightedge or string line placed transverse to the centerline of pavement. The Contractor shall correct variations exceeding 6 mm by removing defective work and replacing it with new material as directed by the Owner. The Contractor shall furnish a 3 m straightedge for the Owner's use.

401.12 Conditioning of Existing Surface. The Contractor shall thoroughly clean the surface upon which Hot Mix Asphalt Pavement is to be placed of all objectionable material. When the surface of the existing base or pavement is irregular, the Contractor shall bring it to uniform grade and cross section.

401.13 Hot Mix Asphalt Material Documentation. The Contractor and the Owner shall agree on the amount of Hot Mix Asphalt Pavement that has been placed each day.

401.14 Preparation of Aggregates. The Contractor shall dry and heat the aggregates for the mixture to the required temperature. The Contractor shall properly adjust flames to avoid physical damage to the aggregate and to avoid depositing soot on the aggregate.

401.15 Mixing. The Contractor shall combine the dried aggregate in the mixer in the amount of each fraction of aggregate required to meet the JMF. The Contractor shall measure the amount of PGAB and introduce it into the mixer in the amount specified by the JMF.

The Contractor shall produce the mixture at the temperature established by the JMF.

The Contractor shall dry the aggregate sufficiently so that the mixture will not flush, foam excessively, or displace excessively under the action of the rollers. The Contractor shall introduce the aggregate into the mixer at a temperature of not more than 14º C above the temperature at which the viscosity of the bituminous material being used is 0.150 Pas.

The Contractor shall store and introduce into the mixer the Performance Graded Asphalt Binder at a uniformly maintained temperature at which the viscosity of the material is between 0.150 Pas and 0.300 Pas.

The aggregate shall be completely and uniformly coated with a thorough distribution of the PGAB. The Contractor shall determine the wet mixing time for each plant and for each type of aggregate used.

401.16 Spreading and Finishing. 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.

On the 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, unless otherwise approved by the Owner.

401.17 Compaction. 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.

The Contractor shall immediately correct any displacement occurring as a result of the reversing of the direction of a roller or from other causes to the satisfaction of the Owner. Any operation other than placement of variable depth shim course that results in breakdown of the aggregate shall be discontinued.

Along forms, curbs, headers, walls, and other places not accessible to the roller, 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.

401.18 Joints. The Contractor shall construct wearing course transverse joints in such a manner that minimum tolerances shown in section 401.111 are met when measured with a straightedge.

The paver shall always maintain a uniform head of material during the joint construction. The bituminous 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. The Owner may allow feathered or “lap” joints on lower courses or when matching existing low type pavements.

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 Owner 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.

Where pavement under this Contract joins an existing pavement of when the Owner directs, the Contractor shall cut the existing pavement along a smooth line, producing a neat, even, vertical joint. The Owner will not permit broken or raveled edges. The cost of all work necessary for the preparation of joints is incidental to related Contract items.

401.19 Quality Control Method A & B.

The Contractor shall operate in accordance with the approved Quality Control Plan (QCP) to assure a product meeting the Contract requirements. The QCP shall meet the requirements of 106.031 and these Special

Provisions. The Contractor shall not begin paving operations until the QCP is approved in writing by the Owner.

Prior to placing any mix, the Owner and the Contractor shall hold a Pre-paving conference to discuss the paving schedule, source of mix, type and amount of equipment to be used, sequence of paving pattern, rate of mix supply, and traffic control. All field and plant supervisors including the responsible onsite paving supervisor shall attend this meeting.

The QCP shall address all elements which affect the quality of the Plant Mix Pavement including, but not limited to, the following:

(a) JMF(s)
(b) Hot asphalt mix plant details
(c) Stockpile Management (to include provisions for a minimum 2 day stockpile)
(d) Make & type of paver(s)
(e) Make & type of rollers including weight, weight per inch of steel wheels, and average contact pressure for pneumatic tired rollers
(f) Name of QCP Administrator, and certification number
(g) Name of Process Control Technician(s), and certification number(s)
(h) Name of Quality Control Technician(s), and certification number(s)
(i) Mixing & transportation including process for ensuring that truck bodies are clean and free of debris or contamination that could adversely affect the finished pavement.
(j) Frequency of and tests for Quality Control pavement
(k) Laydown operations including longitudinal joint construction, procedures for avoiding paving in inclement weather, tacking of all joints, methods to ensure that segregation is minimized, procedures to determine the maximum rolling and paving speeds based on best engineering practices as well as past experience in achieving the best possible rideability of the pavement.
(l) Examples of Quality Control Forms
(m) Process for compacting paved shoulders and traveled way for method B projects
(n) Silo management and details (can show storage for use on project of up to 36 hours)
(o) Provisions for varying mix temperature due to extraordinary conditions.
(p) Name and responsibilities of the Responsible onsite Paving Supervisor

The QCP shall include the following technicians together with these minimum requirements:

(a) QCP Administrator – A qualified individual shall administer the QCP. The QCP Administrator must be a full-time employee of or a consultant engaged by the Contractor or paving subcontractor. The QCP Administrator shall have full authority to institute any and all actions necessary for the successful operation of the QCP. The QCP Administrator (or its designee in the QCP Administrator's absence) shall be available to communicate with the Owner at all times. The QCP Administrator shall be certified as a Plant Technician or Paving Technician certified by the New England Transportation Technician Certification Program.

(b) Process Control Technician(s) (PCT) shall utilize test results and other quality control practices to assure the quality of aggregates and other mix components and control proportioning to meet the JMF(s). The PCT shall periodically inspect all equipment used in mixing to assure it is operating properly and that mixing conforms to the mix design(s) and other Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented and whether more than one PCT is required. The Plan shall include the criteria to be utilized by the PCT to correct or reject unsatisfactory materials. The PCT shall be certified as a Plant Technician by the New England Transportation Certification Program.

(c) Quality Control Technician(s) (QCT) shall perform and utilize quality control tests at the job site to assure that delivered materials meet the requirements of the JMF(s). The QCT shall inspect all equipment utilized in transporting, laydown, and compacting to assure it is operating properly and that all laydown and compaction conform to the Contract requirements. The QCP shall detail how these duties and responsibilities are to be accomplished and documented, and whether more than one QCT is required. The QCP shall include the criteria utilized by the QCT to correct or reject unsatisfactory materials. The QCT shall be certified as a Paving Technician by the New England Transportation Technician Certification Program.

The QCP shall detail the coordination of the activities of the Plan Administrator, the PCT and the QCT. The project Superintendent shall be named in the QCP, and his responsibilities for successful implementation of the QCP shall be outlined.

The Contractor shall sample, test, and evaluate Hot Mix Asphalt Pavement in accordance with the following minimum frequencies:

Table 4: MINIMUM QUALITY CONTROL FREQUENCIES

Test or Action	Frequency	Test Method
Temperature of mix	6 per day at street and plant	-
Temperature of Mat	4 per day	-
% TMD (Surface)	1 per 150 Mg	ASTM D-2950*
% TMD (Base)	1 per 600 Mg	AASHTO T-166
Fines/Effective Binder	1 per 1200 Mg	AASHTO TP-4
Gradation	1 per 600 Mg	AASHTO T-30
PGAB content	1 per 600 Mg	AASHTO T-164, T-287 or TP 53
Voids at N_{design}	1 per 600 Mg	AASHTO TP-4
Voids in Mineral Aggregate at N_{design}	1 per 600 Mg	AASHTO TP-4
Rice Specific Gravity	1 per 600 Mg	AASHTO T-209
Coarse Aggregate Angularity	1 per 6000 Mg	ASTM D 5821
Flat and Elongated Particles	1 per 6000 Mg	ASTM D-4791
Fine Aggregate Angularity	1 per 6000 Mg	AASHTO TP33

* May be modified according to the MDOT's policy on file at the Central Lab in Bangor.

The Contractor may utilize innovative equipment or techniques not addressed by the Contract documents to produce or monitor the production of the mix, subject to approval by the Owner.

The Contractor shall record all Hot Mix Asphalt Pavement plant test results in writing, signed by the appropriate technician and present them to the Owner by 10:00 AM on the next working day, except when otherwise noted in the QCP due to local restrictions. The Contractor shall make density test results, including randomly sampled densities, available to, and summaries of each day's results shall be recorded and signed by the QCT and presented to the Owner by 10:00 AM the next working day.

The Contractor shall have a testing lab at the plant site, equipped with all testing equipment necessary to complete the tests in Table 4. The Contractor shall locate an approved SHRP Gyratory Compactor at the plant testing lab or within 30 minutes of the plant site.

The Contractor shall fill all holes in the pavement resulting from cutting cores by the Contractor or the Owner with an acceptable mixture no later than the following working day. Before filling, the Contractor shall carefully clean the holes and apply a coating of emulsified asphalt. On surface courses, cores shall not be cut except for calibration of the Nuclear Density Gauge, or as directed by QA testing by the Owner. On a daily basis, the Contractor shall perform nuclear density testing across the mat being placed, at 300 mm intervals. If the values vary by more than 2.0% from the mean, the Contractor shall make adjustments until the inconsistencies are remedied.

The Contractor shall monitor plant production using control charts as specified in Section 106. If plotted test results indicate a production problem, the Contractor shall notify the Owner and take corrective action acceptable to the Owner. The Contractor shall keep control charts up to date and available for review by the Owner at any time.

The Contractor may construct a pavement test strip on a given project at the option of the Contractor for each individual JMF. Prior to test strip placement the Contractor shall deliver a written notice to the Owner notifying that a test strip will be scheduled. Prior to placement of the test strip, a passing verification test is required.

The test strip shall not exceed 800 M. The quantity of Hot Mix Asphalt produced for the test strip shall not exceed 700 MG, 4 hours production, or 4% of the total quantity for the project, as determined by the Owner.

The test strip is intended to allow the Contractor to establish rolling patterns to achieve optimum density for the mat being laid. The Owner will not test the first third of the mat, allowing the plant to "balance itself". The Owner will calibrate thin lift densometers against cut cores. For surface mixes, the Owner will select 3 test sites and take 4 shots at each site. For base and binder mixes, 3 cores shall be run for density verification. The Contractor shall not commence full production until the calibrations are complete and the test strip has attained its minimum values for percent voids and percent TMD.

Should the test strip fail to meet an average density of 89% or greater (minimum of 3 tests, maximum of 7 including re-tests) or should the volumetrics, based on QC results, be outside of the 3-6% range, the Owner will reject the test strip. The Contractor shall remove and replace rejected test strips at their expense. The test strip shall be considered part of the project pavement and no separate payment will be made.

The Contractor shall cease paving operations whenever one of the following occurs on a lot in progress:

(1) The Pay Factor (which will be used for QA purposes only) for VMA, Voids @ N_d, Percent PGAB, composite gradation, VFB, fines to effective binder or density using all available tests is less than 0.90.

(2) The Coarse Aggregate Angularity or Fine Aggregate Angularity value falls below the requirements of Table 3 for the design traffic level.

(3) The first 2 control tests for the lot fall outside the upper or lower limits.

(4) The Flat and Elongated Particles value exceeds 10 percent by ASTM D-4791.

(5) There is any visible damage to the aggregate due to over-densification other than on variable depth shim courses.

(6) The Contractor fails to follow the approved QCP.

Paving operations shall not resume until the Contractor and the Owner determine that material meeting the Contract requirements will be produced. The Owner will consider corrective action acceptable if the Pay Factor for the failing property increases. If the Owner determines that the resumption of production involves a significant change to the production process, the current lot will be terminated and a new lot will begin.

401.20 Quality Assurance.

Method A

This method utilizes Quality Level Analysis and Pay Factor specifications. However, the pay factor shall be utilized to evaluate pavement performance only. Payment for all material and labor to place the payment shall be included in the Lump Sum contract. No separate payment will be made.

For asphalt pavement designated for acceptance under Quality Assurance (QA) provisions, the Owner will sample once per sublot on a statistically random basis, test, and evaluate in accordance with the following Acceptance Criteria:

Table 5: ACCEPTANCE CRITERIA

PROPERTIES	POINT OF SAMPLING	LOT SIZE	SUBLOT SIZE	TEST METHOD
Gradation	Paver Hopper	JMF*	1200 Mg	AASHTO T-30
PGAB Content	Paver Hopper	JMF*	1200 Mg	AASHTO TP-53
% TMD (Surface)	Mat behind all Rollers	JMF*	300 Mg	ASTM-2950/ AASHTO T-166
% TMD (Base or Binder)	Mat behind all Rollers	JMF*	600 Mg	AASHTO T-166
Air Voids at N_d	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Voids in Mineral Aggregate at N_d	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Fines to Effective Binder	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4
Voids Filled with Binder	Paver Hopper	JMF*	1200 Mg	AASHTO TP-4

* Not to exceed 6,000 Mg, unless an unplanned overrun less than 2400 MG, or agreed to at the Pre-Construction Conference.

On the first day of production the Owner will take 3 random samples which will be used to calculate the quality level of the in-place material in the event the lot is terminated prematurely. Only 1 of the 3 will be for tested, the other 2 will be held onsite until at least 3 random samples have been taken, at which time the other 2 will be discarded.

(a) Lot Size. For purposes of evaluating all acceptance test properties, a lot shall consist of the total quantity represented by each item listed under the lot size heading in the table above. Each lot will be divided into at least 3 sublots, 5 where possible.

(b) Sublot size. The quantity represented by each sample will constitute a sublot. The size of each sublot shall be as listed under the sublot size heading in the table above. If there is insufficient quantity in a lot to make up at least three sublots, then the lot quantity will be divided into three equal sublots.

If there is less than one half of a sublot remaining at the end, then it shall be combined with the previous sublot. If there is more than one half sublot remaining at the end, then it shall constitute the last sublot and shall be represented by test results.

(c) Rejection by Contractor. The Contractor may, prior to sampling, elect to remove any defective material and replace it with new material at no expense to the Owner. The Owner will sample, test, and evaluate any such new material for acceptance. The Owner will review any test results for density below 90%, and areas found to be deficient shall be isolated and 3 random tests taken. If the resultant Pay Factor falls at or below 0.75, the Contractor shall remove and replace the material for the full lane width for a length of no less than 50 Meters at no expense to the Owner.

(d) Acceptance Testing. The Owner will obtain samples of Hot Mix Asphalt Pavement in conformance with AASHTO T168 – Sampling Bituminous Paving Mixtures. The Owner will take the sample randomly within each sublot. Target values shall be as specified in the JMF. The Owner will use the following Table for calculating Pay Factors for gradation, PGAB content, air voids at N_d, VMA, Fines to Effective Binder and VFB.

Table 6: GRADATION, VOLUMETRIC AND ASPHALT CEMENT ACCEPTANCE LIMITS

Property	USL and LSL
Passing 4.75 mm and larger sieves	Target ± 7 percent
Passing 2.36 mm to 1.18 mm sieves	Target ± 4 percent
Passing 0.60 mm	Target ± 3 percent
Passing 0.30 mm to .075 mm sieve	Target ± 2 percent
PGAB Content	Target ± 0.4 percent
Air Voids	Target ± 1.5 percent
Fines to Effective Binder	0.6% to 1.4%
Voids in the Mineral Aggregate	JMF Target -/+ 1.5% but not more than 0.5% below the table 2 Min. Value
Voids Filled with Binder	Target +/- 5%

Prior to paving, the Contractor shall determine whether testing of the surface for density QA will be done with cores or the Nuclear Density Gauge. If the Owner tests with the Nuclear Method, then the following table shall apply:

Table 7a: Density Acceptance Limits

	TARGET	LSL	USL
% of Maximum Theoretical Density	94.5	92.0	97.0

The Owner will designate a control section of pavement approximately 150 m long at the start of the paving operations. Within the control section at least three locations will be tested at the same offset at approximately a 2 M spacing to calibrate the nuclear density gauge. After placement of pavement, the Contractor shall cool the pavement to be tested by using ice and promptly cut the necessary calibration cores. After cooling to 20^{o} C, the Contractor shall remove the cores using a core removing tool to assure minimum damage to the core. The Owner will adjust the nuclear density gauge to reflect the average of the cores. The Owner reserves the right to designate a new control section at any time. When nuclear testing is performed at locations outside normal paving and traffic control areas, the Contractor shall furnish a flagger and other necessary safety devices to protect personnel and equipment.

For base of binder courses, or for surface course when the nuclear density gauge is not available and the Owner so directs, the Contractor shall cut cores within 24 hours of placement of the pavement, or by the end of the next working day.

If the Owner tests with the Core Method then the following Table shall apply:

Table 7b: Density Acceptance Limits

	TARGET	LSL	USL
% of Maximum Theoretical Density	95.0	92.5	97.5

The Owner will measure pavement density on the compacted wearing surface using core samples tested according to AASHTO T-166. The Owner will randomly determine core locations. The Contractor shall cut cores at no additional cost to the Owner within 24 hours of placement of the pavement, and immediately give them to the Owner. At the time of sampling, the Contractor and the Owner shall mutually determine if a core is damaged. If it is determined that the core(s) is damaged, the Contractor shall cut new core(s) adjacent to the initial sample. In the Owner's presence, the Contractor may saw-cut the bottom of the core onsite without disturbing the layer being tested to remove lower layers of Hot Mix Asphalt Pavement, gravel, or RAP. No recuts are allowed at a test location after the core has been tested.

The minimum acceptable density for shoulders shall be 90.0% unless waived by the Owner due to local conditions that make densification to this point detrimental to the finished pavement.

Method B

Method B utilizes Product Verification testing to determine the quality of the material incorporated into the project. The Hot Mix Asphalt Pavement (other than that placed outside the traveled way and shoulders) shall meet the material properties in Tables 1 through 3. Aggregates and Mix shall meet the Consensus and Volumetric properties in Table 8 and Section 401.03, Aggregates, utilizing the testing methods and sampling procedures in Table 5.

For the traveled way density will be tested with 3 random cores, and statistically evaluated for Pay Factors with a USL of 98.0% and an LSL of 92.0%. If the resultant Pay Factor is 0.75 or below, the Contractor shall remove and replace the material with mix meeting the specifications at no additional cost to the Owner.

Only the Owner shall be allowed to dispute whether the test results reflect the true quality of the mix.

Unless otherwise noted, the Owner will verify density by inspection to ensure that the proper compaction procedures are complied with. The Owner may test for density to ensure that the Contractor's method attains acceptable results. At any time, the Owner may take samples from the source of production to determine the properties shown in Table 8, Section 401.03, Aggregates, or will verify these properties with test results from another project done during the same time period.

Table 8: GRADATION, VOLUMETRIC AND PGAB CONTENT VERIFICATION LIMITS (METHOD B)

	USL and LSL		
	Mainline	Shoulder	Drives & Sidewalks
Percent Passing 4.75 mm and larger sieves	Target ± 7	Target ± 7	Target ± 7
Percent Passing 2.36 mm to 1.18 mm sieves	Target ± 5	Target ± 5	Target ± 5
Percent Passing 0.60 mm	Target ± 4	Target ± 4	Target ± 4
Percent Passing 0.30 mm to 0.75 mm sieve	Target ± 3	Target ± 3	Target ± 3
PGAB Content	Target ± 0.5	Target ± 0.5	Target ± 0.5
Air Voids	4.0% ± 2.0	4.0% ± 2.0	Not Applicable
Fines to Effective Binder	0.6% to 1.6%	0.6% to 1.6%	Not Applicable
Voids in the Mineral Aggregate	JMF Target ± 1.5%*	JMF Target ± 1.5%*	Not Applicable
Voids Filled with Binder	Target ± 5%	Target ± 5%	Not Applicable

* But not more than 0.5% below the Table 2 Min. Value

For PGAB Content, Gradation, and Volumetric properties on items covered under Method B, the Owner may take 3 or more random samples from the material delivered to the project. The Owner may elect to test one or more of these samples to evaluate the quality of the mix. If there is concern about the quality, the Owner will test 3 or more random samples to determine a Pay Factor for each property using Table 8 USLs and LSLs. The Owner may reject material with a 0.75 pay factor or less. If the PF is less than 1.00 but greater than 0.75, price adjustments may be made accordingly. If the PF is 1.00 or greater the Owner will pay the full contract price.

401.21 Method of Measurement and Payment. All material, equipment and labor required to produce, place and test the asphalt pavement shall be included in the Lump Sum contract except testing by the independent testing laboratory hired by the Owner. No quantity measurement will be made for any pavement placed under this contract.

401.22 Basis of Payment. Payment for all paving activity shall be included in the Project Lump Sum contract price.

This Work shall include all labor, equipment, materials, and incidentals necessary to meet all related Contract requirements, including design of the JMF, implementation of the QCP, obtaining core samples, filling core holes, applying emulsified asphalt to joints, and providing testing facilities and equipment. Cleaning objectionable material from the pavement and furnishing and applying bituminous material to joints and contact surfaces is incidental.

No separate payment will be made for any pavement work under this Contract.

401.222 Pay Factor (PF) (Method A Only). The Owner will use density, Performance Graded Asphalt Binder content, voids @ N_d, VMA, VFB, F/B^e, and the screen sizes listed below (Table 9) for the type of material represented in the JMF. The Owner will evaluate materials using the following price adjustment factors under Subsection 106.033 for QA purposes only and no additional payment will be based on these calculations.

Table 9: Table of Gradation Composite "f" Factors
(Method A)

Constituent		"f" Factor				
		25 mm	19 mm	12.5 mm	9.5 mm Surface	9.5 mm Other
Gradation	25 mm	4	-	-	-	-
	19 mm		4	-	-	-
	12.5 mm			4	-	-
	9.50 mm				4	4
	2.36 mm	6	6	6	6	6
	1.18 mm					
	0.60 mm	2	2	2	2	2
	0.30 mm	2	2	2	2	2
	0.075 mm	6	6	6	6	6

For each lot of material, the Owner will determine a price adjustment as follows:

Gradation. The Owner will determine a composite pay factor (PF) using applicable price adjustment factors "f" from Table 9 and acceptance limits from Table 6. The Owner will not make price adjustments for gradations, but will monitor them as a shutdown criteria.

VFB and Fines to Effective Binder. The Owner will determine a pay factor (PF) using acceptance limits from Table 6. The Owner will not make price adjustments for VFB or Fines to Effective Binder, but will monitor them as a shutdown criteria.

Density. For mixes having a density requirement, the Owner will determine a Pay Factor using acceptance limits from Table 7a or 7b.

PGAB Content, VMA and Air Voids. For mixes having a Volumetric requirement, the Owner will determine a Pay Factor using acceptance limits from Table 6.

If any single Pay Factor for PGAB Content, VMA, Air Voids or Density falls below 0.75, the Owner will reject the material.

401.223 Process for Dispute Resolution (Method A Only).

The Owner will take a split for each QA test random sample, including mix samples for PGAB content, volumetrics and gradation, and label and store them to allow at least 2 working days for the Contractor to notify the Owner in writing of any disputes. At the time of sampling, the Contractor may also take a split sample of the material.

(a) PGAB content. To contest PGAB content within a sublot the Contractor must run its split of the original sample. If the Contractor tests its split and the results are equal to or greater than the allowable tolerances in Table 10, and notifies the Owner in writing within 2 working days of receiving the QA test results, the Owner will retest for PGAB content by the ignition method. If the re-test result is within the allowable tolerance shown in Table 10, the original test result will be used. If the re-test is equal to or greater than the allowable tolerances from Table 10 the new value will be used to calculate PGAB Content, VMA, VFB and Fines to Effective Binder.

(b) Density. To contest a nuclear density reading within a sublot, 1) the Contractor's nuclear gauge must have been calibrated using the same cores as the QA test gauge, and 2) the QC test must have been taken at the same location, and 3) the difference must have been greater than the tolerance allowed inn Table 10. If the difference is greater, the Contractor may request a new reading be taken by the QA Technician within 10 meters at the same offset from centerline. If this result is within Table 10 tolerance, the Owner will use the initial QA test. If the resulting density reading differs more than allowed in Table 10, the Owner will use the second reading. If the difference is less than the tolerance allowed in Table 10, the Owner will use the original reading.

If the Contractor and the Owner believe that the mat being tested may be 5 mm less than the designated thickness or thinner, the Contractor may cut a core in the same location as the original test. If the core is found to be 5 mm or more thinner than the designated thickness, then the Owner will test the core. If the density results exceed the tolerances allowed in Table 10, then the Owner will substitute the core value for the nuclear value. Re-testing may only take place after the area is opened to traffic if approved by the Owner. On any pavement thickness found to be less than 30 mm, the Owner will determine density using the core.

Where the Owner tests for density by the core method, no disputes will be allowed unless based on evidence that the results are inaccurate, as reasonably determined by the Owner.

(c) Volumetric. If the Contractor believes that the Owner's test results vary significantly from the Contractor's results, the Contractor may dispute the Owner's results by testing their split of the original sample. If the Contractor's results vary from the Owner's results by more than the tolerance in Table 10, and the Owner is notified in writing within at least 2 working days of the Contractor receiving QA test results, the Owner will

re-test the remaining split of the original sample. If the Owner's re-test is within the allowable tolerance shown in Table 10, the original test shall stand. If the re-test is outside the allowable tolerances from Table 10 but is within the Table 10 tolerance of the Contractor's test, the Owner will use the second value.

When the Contractor has initiated 3 disputes that have not been overturned, further disputes resulting in no change will be paid for by the Contractor at the rates established by the Owner.

Table 10. Dispute Resolution Variance Limits

PGAB Content	$\pm$ 0.3%*
Density	$\pm$ 1.0%
Voids @ N_d	$\pm$ 0.8%
VMA	$\pm$ 0.8%

* 0.4% will be used if the Contractor uses any method other than TP53.

END OF SECTION-APPENDIX A

SECTION 32 16 00

CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete, Paver, Bluestone, Brick or Bituminous Sidewalks

B. Granite Curb

C. Bituminous Curb (Not in Contract)

D. Concrete Curb (Not in Contract)

E. Exterior Plaza Areas or Special Materials for Walks

F. Detectable Warning Pavers set on sand leveling course over bituminous asphalt layer.

1.2 RELATED SECTIONS

A. Section 31 10 00 - Site Clearing

B. Section 31 20 00 – Earth Moving

C. Section 32 11 00 - Base Courses

D. Section 32 17 23.13 – Painted Pavement Markings

E. Division 03 30 00 – Concrete

F. Maine Department of Transportation Standard Specifications, Current Edition

G. Construction Documents.

1.3 SECTION EXCLUDES STRUCTURAL SLABS AT ENTRANCES – VACANT

1.4 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

B. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural construction.

C. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. ASTM C33 - Concrete Aggregates.

E. ASTM C94 - Ready Mix Concrete.

F. ASTM C150 - Portland Cement

G. ASTM C260 - Air-Entraining Admixtures for Concrete.

H. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

I. ASTM C494 - Chemical Admixtures for Concrete.

J. FA TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

K. MDOT and New Hampshire specifications for Highway and Bridge construction, current edition.

1.5 PERFORMANCE REQUIREMENTS

A. Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

1.6 SUBMITTALS

A. Product Data: For materials other than water and aggregates.

B. Samples for unit pavers.

1.7 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or build on frozen subgrade or setting beds.

B. Weather Limitations for Bituminous Setting Bed: Install bituminous setting bed only when ambient temperature is above 40 deg F (4 deg C) and when base is dry.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Do not apply mortar to substrates with temperatures of 100 deg F (38 deg C) and higher.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Owner.

C. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required. Any concrete outside of the building and not a structural slab shall be part of the Sitework for the project.

D. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.

E. Joint Sealers: Non-priming, pourable, self-leveling polyurethane. Acceptable sealants are Sonneborn "Sonolastic Paving Joint Sealant", Sonneborn "Sonomeric CT 1 Sealant", Sonneborn "Sonomeric CT 2 Sealant", Mameco "Vulken 45", or Woodmont Products "Chem-Caulk".

F. Granite Curb: All curb shall be of granite mined and cut in the United States of America. Type 1 granite headstones shall be used at all catch basin inlets. Granite at all ADA ramps shall be Type 1.

G. Bituminous Curb shall be used where required on the Contract Drawings and shall be installed in accordance with Section 609 of the MDOT specifications. Fiberglass resin shall be used in all curb. Coatings pursuant to MDOT specifications (seal coat) shall be provided for all bituminous curb.

H. Aggregates subbase gravels and base gravels (if appropriate) for sidewalks shall meet the requirements of Section 32 11 00 of these specifications.

I. Asphaltic concrete pavement for sidewalks shall meet the requirements of Section 32 12 16 of these specifications.

J. Aggregate Base: Material for aggregate base course shall be a graded, granular, non-frost susceptible, free-draining material, consisting of either durable stone and coarse sand or of blast furnace slag, practically free from loam and clay, and which can be readily compacted to form a stable foundation.

1. Material shall conform to MDOT Specifications Section 703.06, “Aggregate for Base” Type A gravel.

K. Sand:

1. Sand for setting bed and for between pavers shall be a clean, washed river or bank sand conforming to ASTM C 144.

2. Sand shall be supplied by a single source. Source of supply shall not be changed during course of project without written permission of the Engineer.

L. Bituminous Setting Bed:

1. Asphalt cement to be used in the bituminous setting bed shall conform to ASTM D 3381. Viscosity grade shall be A.C. 10 or A.C. 20.

2. Fine aggregate to be used in the bituminous setting bed shall be clean, hard sand with durable particles and free from adherent coating, lumps of clay, alkali salts, and organic matter. Aggregate shall be uniformly graded from "coarse" to "fine" with 100% by weight passing the No. 4 sieve and shall meet the gradation requirements when tested in accordance with ASTM C 136.

3. Fine aggregate shall be dried and shall be combined with hot asphalt cement, and the mix shall be heated to approximately 300º F. at an asphalt plant. The approximate proportion of materials shall be 7% cement asphalt and 93% fine aggregate. Each tone of material shall be apportioned by weight in the approximate ratio of 145 lb. Asphalt to 1,855 lb. Sand. The Contractor shall determine the exact proportions to produce the best possible mixture for construction of the bituminous setting bed to meet specified requirements.

M. Concrete Pavers: Pavers shall be of a color selected by the Owner and, where necessary, comply with the ADA requirements for tactile warning strips.

1. Pavers shall have an average compressive strength of 5000 psi.

2. Water absorption shall be less than 5%.

3. No weight loss or visual signs of deterioration after 50 cycles of freeze-thaw, or three-day application of rock salt (wet).

4. Allowable tolerance shall be plus or minus 1/16 in. any direction.

N. Joint Mortar: Dry set mortar for header courses shall conform to ASTM C 270, Type M.

O. Edging – Edge Restrains: Use approved edge restrains where pavement or concrete does not abut the pavers.

P. Water: Water shall be potable and shall be free of injurious contaminants.

Q. Catalog cuts and information on the curb supplier shall be submitted to the Engineer for approval prior to ordering the material.

2.2 MIX DESIGN AND TESTING

A. Concrete mix design and testing shall comply with requirements of applicable Division 03 30 00 – Concrete.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce the following properties:

1. Compressive Strength: 4,000 psi, minimum at 28 days, unless otherwise indicated on the Drawings.
2. Slump Range: 3"-5" for normal concrete at time of placement
3. Air Entrainment: 4% to 6%

2.3 BRICK MATERIALS

A. Materials:

1. Materials shall conform to the requirements of the various subsections of the specifications listed below:

a. New Brick: Conform to the various subsections of the specifications listed below:

Brick – Brick shall conform to requirements of ASTM Standard Specifications for Building Brick (made of clay or shale) Designation C62-66 for Grade SW with the following modifications:

1. The absorption limits shall be less than 8 percent for the average of 5 bricks.
2. The compressive strength shall not be less than 8000 pounds per square inch (psi).
3. The modulus of rupture shall not be less than 1000 pounds per square inch (psi).
4. The bricks shall be No. 1, wire cut type for paving.

b. Bricks shall be Pinehall/Pathway 4x8 Lachance Item #193623 as distributed by Morin Brick of Auburn, Maine. Prior to ordering the brick, samples shall be submitted in whole strips to show color range.

2.4 CLAY DETECTABLE WARNING PAVERS

A. Material: Clay detectable warning pavers with detectable warning surface with dome configuration that complies with ADA requirements.

B. Manufacturers: Subject to compliance with requirements, provide products by :

1. Whitacre – Greer – www.wgpaver.com

2. Pavestone, or approved equal

C. Size: 4 inches x 2 ¼ inches

D. Color: Yellow or Maize

2.5 BLUE STONE PAVERS

A. Material: Blue Stone Pavers, rectangular and square paving slabs made from slate complying with ASTM C629, Classification I Exterior, with a fine, even grain and unfading color, from clear, sound stock.

B. Products: VACANT

C. Color: Blue-gray

D. Finish: Natural cleft without tool-made blemishes or underdraining depressed areas.

E. Thickness: Not less than 1 ½ inches (39 mm)

F. Face Size: 12 x 24 inches (nominal) to 18 x 24 inches (nominal).

2.6 EDGE RESTRAINTS

A. Edges shall be restrained by mortar placed beneath out paver/brick edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

B. Cut unit pavers with motor-driven masonry saw equipment to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.

1. Smallest acceptable cut stone dimension: 8 inches
2. Smallest claypaver dimension: 2 inches.

C. Joint Pattern: Running bond.

D. Tolerances: Do not exceed[**1/16-inch (1.6-mm) unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches (3 mm in 600 mm) and**] 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope, for finished surface of paving.

E. Expansion and Control Joints: Provide for sealant-filled joints at building foundation and against concrete slabs or foundation. Provide compressible foam filler as backing for sealant-filled joints as necessary. Install joint filler before setting pavers. Sealant materials and installation are specified in Division 07 Section "Joint Sealants." Make top of joint filler flush with top of pavers.

F. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

3.2 PREPARATION FOR SIDEWALKS

A. Prepare subgrade to receive sidewalk subbase gravel in accordance with Section 32 11 00.

B. Place and compact subbase and base gravel in accordance with Section 31 20 00 and 32 11 00 of these specifications.

C. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

D. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.

3.3 INSTALLATION OF CONCRETE SIDEWALKS (Not in Contract)

A. Form Construction:

1. Set forms to required grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place a minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:

   Top of forms not more than 1/8" in 10'-0".

   Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
4. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Locate, place and support reinforcement per Division 3 specifications.

C. Concrete Placement:

1. Comply with requirements of Division 03 30 00 – Concrete.

2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall not be placed around manholes or other structure until they are at the required finish elevation and alignment.

3. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.

4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.

D. Joint Construction:

1. Contraction Joints: If joints are specified, the curb, gutter, or sidewalk shall be constructed in uniform sections of the length specified on the plans. If no length is called out on the drawings the distance shall not exceed 6'-0". The joints between sections shall be formed either by steel templates 1/8 inch in thickness, or a length equal to the width of the gutter or curb, and with a depth which will penetrate at least 2 inches below the surface of the curb and gutter; or with 3/4 inch thick preformed expansion joint filler cut to the exact cross section of the curb or gutter; or by sawing to a depth of at least 2 inches while the concrete is between 4 to 24 hours old. If steel templates are used, they shall be left in place until the concrete has set sufficiently to hold its shape, but shall be removed while the forms are still in place.

2. Longitudinal Construction Joints: Concrete curb, concrete gutter, combination concrete curb and gutter, and sidewalls where specified on the plans, shall be tied to concrete pavement with 1/2 inch round, reinforcement bars of the length and spacing shown on the plans.

3. Transverse Expansion Joints: Transverse expansion joint in curb, curb and gutter, gutter or sidewalk shall have the filler cut to the exact cross section of the curb, curb and gutter, gutter or sidewalk. The joints shall be similar to the type of expansion joint used in the adjacent pavement.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If not joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler section together.

F. Joint Sealants: Exterior pavement joint sealants shall be installed per manufacturer's recommendations.

G. Cold Weather Placing:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions or low temperatures, in compliance with ACI 306 and as specified herein. All expenses associated with the protective measures, temporary heating, etc. shall be at the expense of the Contractor.

When air temperature has fallen to or is expected to fall below 40° F (4° C) uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50° F (10° C) and not more than 80° F (27° C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete or frozen subgrade or subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical agents, unless otherwise accepted in mix design.

H. Concrete Finishing:

1. After striking off and consolidating concrete, smooth surface by screening and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

2. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

   a. Inclined Slab Surfaces: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.

   b. Paving: Provide coarse, nonslip finish by scoring surface with stiff-bristled broom perpendicular to line of traffic.

3. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

4. Protect and cure finished concrete paving using acceptable moist-curing methods, more particularly described in the "water-curing" section of ACI 308-81.

I. Cleaning and Adjusting:

1. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

2. Protect concrete from damage until acceptance of work. 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.

3.4 CONCRETE PAVERS (Detectable Warning Pavers)

A. Acceptability of base:

1. Contractor shall examine the aggregate and bituminous base to determine its adequacy to support concrete pavers. Evidence of inadequate base shall be brought to the immediate attention to the Engineer.

2. Start of work of this Section shall constitute acceptance of the aggregate and bituminous base.

B. Aggregate Base Course: Aggregate material for base beneath concrete pavers shall be to the depth indicated on the Drawings. Base shall be compacted to 95% of the maximum dry density at optimum moisture content, as determined by ASTM D 1557.

C. Bituminous Setting Bed:

1. Bituminous setting bed shall be installed over the aggregate base. Control bars ¾ inc. deep shall be placed directly over the base. If grades must be adjusted, wood chocks under depth control bars shall be set to proper grade. Set two bars parallel to each other to serve as guides for the striking board. The depth control bars must be set carefully to bring the pavers, when laid, to proper grade.

2. While still hot (not less than 250ºF) some of the bituminous bed material shall be placed between the parallel depth control bars. This bed shall be pulled with the striking board over the control bars several times. After each passage, low porous spots shall be showered with fresh bituminous material to produce a smooth, firm, and even setting bed. As soon as this initial panel is completed, advance the first bar to the next position in readiness for striking the next panel. After the depth control bars and wood chocks have been removed, carefully fill any depressions that remain.

3. The setting bed shall be rolled with a power roller to a nominal depth of ¾ in., while still hot. The thickness shall be adjusted so that when the bricks are placed and rolled, the top surface of the pavers will be at the required finished grade.

D. Sand Setting Bed:

1. Sand shall be spread over bituminous base course as a setting bed for pavers. Sand shall be spread and leveled to require slope and grade. Minimum thickness of sand shall be 1 in. after leveling. Bed shall not be compacted until pavers are installed.

2. Surface tolerance shall be within ¼ in. of required grade as measured with a 10 ft. straightedge in both the transverse and longitudinal directions.

E. Setting Concrete Pavers:

1. Setting bed shall be protected from damage prior to setting pavers.

2. Setting shall be done by competent workmen under adequate supervision, and in accordance with manufacturer's recommendations. Pavers shall be placed on the setting bed, to true line and plane and in required position. Surface edge of one paver shall be level with the next adjacent pavers so that no voids, rocking motions, or tripping hazards are encountered. Edge to edge arris shall not exceed 1/16 in.

3. Pavers with chips, cracks, or other structural or aesthetic defects shall not be used.

4. Pavers shall be set true to the required lines and grades in the pattern detailed on the Drawings. Pavers shall be tightly butted. Joints between pavers shall be uniform and shall not exceed 1/8 in.

5. After a sufficient area of pavers has been installed, joints of pavers shall be filled by sweeping stone dust into the joints. When joints are filled, paver surfaces shall be swept clean of stone dust.

6. Where required, pavers shall be accurately cut with a masonry or concrete saw. Cut edges shall be plumb and straight. Scoring and breaking will not be acceptable.

7. Completed surface shall be compacted by running a medium plate vibrator across the top of the pavers. Additional stone dust material shall be swept in the joints during vibration to completely fill joint space.

8. When joints are filled, paver surfaces shall be swept clean of excess stone dust. Swept surfaces shall then be thoroughly dampened with a low-volume fine spray of water.

F. Joint Treatment:

1. Header Courses: Dry set mortar shall be installed in the joints of header courses.

2. Remainder of Joints: On a dry day, after pavers have been installed, joints of pavers shall be filled by sweeping dry sand into the joints. When joints are filled, paver surfaces shall be swept clean, and hosed down with low-volume fine spray of water.

G. Cleaning of Paved Surface: After completion of concrete pavers, paved areas shall be thoroughly swept clean and surface shall be left unsoiled. Where required, surface shall be cleaned with water or an approved cleaner.

3.5 INSTALLATION OF GRANITE CURB

A. Granite curbing will be installed and backfilled in accordance with provisions of Paragraph 3.06. If Type 5 sloped curb configuration is used, the curb shall be set on a slope as shown on the plans. All granite curb used to form a radius and any granite curb of any type with stone length of less than 36" shall be backfilled with lean concrete to a level equal to the binder pavement surface in front of the curb and a level equal to 3" below finish grade behind the curb.

B. Protect the granite curb from damage throughout construction and until substantial completion.

3.6 BITUMINOUS CURB (Not in Contract)

A. Bituminous curb shall be installed on the bituminous pavement base course prior to placement of final bituminous pavement wearing course. The curb shall be backfilled with approved materials. That shall be placed in layers not exceeding 8 inches in depth, loose measure and thoroughly tamped.

B. Bituminous curb shall be seal coated after placement in accordance with MDOT Standard Highway specifications.

3.7 HOT BITUMINOUS CONCRETE SIDEWALKS (Not in Contract)

A. Bituminous concrete pavement for sidewalks shall be placed in two lifts to provide the total thickness specified on the drawings.

B. Compaction shall be by a paver roller having a minimum total weight of 2,000 lb. with a minimum of 65 lbs. per inch of drive roll or by satisfactory vibratory equipment.

C. Placement and quality control shall comply with Section 32 12 16 of these specifications.

3.8 BRICK SIDEWALK INSTALLATION

A. Description: This work shall consist of the construction of brick sidewalks and driveways on bituminous concrete base in accordance with these specifications and the City of Portland Technical Standards and in reasonably close conformity with the lines and grades as shown on the plans.

1. Subgrade: The subgrade for the sidewalks and driveways shall be shaped parallel to the proposed surface of the walks and drives and shall be thoroughly compacted. All depressions occurring shall be filled with a suitable material and again compacted until the surface is smooth and hard.
2. Foundation: After the subgrade has been prepared, a foundation of crushed gravel shall be placed upon it. After being thoroughly compacted, the foundation shall have a thickness as shown on the plans and typical details and shall be parallel to the proposed surface of the work.
3. Bituminous Base: A layer of hot bituminous pavement grading "B" shall be spread upon the properly prepared crushed gravel. After being thoroughly compacted, the bituminous base course shall have a minimum thickness of two inches (2") and shall be parallel to the proposed finish grade.
4. Sand-Cement Base: A layer of sand-cement base course material one inch (1") in thickness shall be spread upon the properly prepared bituminous base course. The course shall be thoroughly compacted and present a hard smooth surface parallel to the proposed finished slope and grade of the walks and drives. The ratio shall be six (6) part of washed mortar sand to one (1) part portland cement.
5. Brick Placement: After the sand base course has been properly prepared, the brick shall be placed in the pattern shown on the plans and typical details. The brick shall be placed as closely together as possible and the sand joints between the brick shall be no wider than that allowed by the natural texture of the brick itself. NO OPEN JOINTS WILL BE ALLOWED. Brick shall be saw cut to fit spaces requiring less than a whole brick. No cut brick shall be less than two inches (2") in length. A journeyman brick mason shall supervise all brick placement.

After the bricks are carefully set upon the properly prepared sand-cement base, a plank or heavy sheet of plywood covering several courses of brick shall be placed upon the bricks and carefully rammed with a heavy hammer until the bricks reach a firm, unyielding bed and present a surface of the proper slope and grade. Any divergence from line and grade shall be corrected by taking up and relaying the bricks. After the ramming of the bricks, a sufficient amount of sand-cement shall be spread over the surface and thoroughly swept or raked so as to fill the joints. All surplus sand-cement remaining on the sidewalk and driveway after the joints have been properly filled, shall be carefully removed by sweeping. Care shall be taken to avoid raking out the joints during removal of excess sand-cement. A final application of sand only shall be spread on the sidewalk. The application of sand shall then be removed by sweeping while the aforementioned precautions are being exercised.

A 12" wide bituminous strip shall be placed at the gutter line and at the back edge of the brick driveway as a transition between the brick and adjoining surfaces.

END OF SECTION 32 16 00

SECTION 32 17 23.13

PAINTED PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS:

A. Section 31 20 00 Earth Moving

B. Section 32 11 00 Base Courses

C. Section 32 12 16 Asphaltic Paving

D. Construction Drawings

1.2 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The paint shall be a non-bleeding, quick-drying, alkyd petroleum base paint suitable for traffic-bearing surfaces and shall meet FS TTP-85E and mixed in accordance with manufacturer's instructions before application.

PART 3 - EXECUTION

3.1 SITE MEETING

A. A site meeting including a representative of the City of Portland Public Services Division, General Contractor, Pavement Marking Subcontractor, and the Owner shall be conducted prior to conducting the work. Marking locations, colors for the markup, and dates of application shall be confirmed at this meeting. The Owner reserves the right to alter or modify said locations at this meeting.

3.2 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

B. Where existing pavement markings are indicated on the drawings to be removed or would interfere with the adhesion of new paint, a motorized device shall be used to remove the markings. The equipment employed shall not damage the existing paving or create a surface

hazardous to vehicle or pedestrian traffic. In all areas within public rights-of-way, the method of marking removal shall be approved by governing authority.

3.3 APPLICATION

A. Apply two (2) applications of paint at manufacturer's recommended rate without the addition of thinner, with a maximum of 125 square feet per gallon. Install during calm (low wind) conditions in order that spray or unintended paint does not affect adjacent areas. Where necessary, apply during periods of the day when traffic can be controlled and barricaded from area where markings are being installed. Use proper barricades, traffic and safety officers. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs and crosswalks, use a straightedge to ensure a uniform, clean, and straight stripe. A minimum of 48 hours shall elapse between the applications.

B. The following items are to be painted with the colors noted below:

Pedestrian Crosswalks: White

Lane Striping where separating traffic in opposite directions: Yellow

Lane Striping where separating traffic in same direction: White

Handicap Symbols: White symbol with 4’ square non-skid blue background or per Local Code and conforming to ADA requirements.

Parking Stall Striping: Yellow

Parking space numbering (if required by plans): White

Stop Bars: White

Directional Arrows: White

Fire Lane: Per Fire Department selection

Chevrons: Yellow

These colors shall be confirmed with the Owner or Owner’s Representative before application.

END OF SECTION 32 17 23.13

SECTION 32 30 00

SITE IMPROVEMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The CONDITIONS OF THE CONTRACT and all Sections of Division 1 are hereby made a part of this Section.

1.2 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, and without limiting the generality thereof furnish and install the following:

1. Benches
2. PVC Solid Waste Enclosure and Fence
3. Ornamental Fence
4. Bicycle Racks

B. Related Work Specified Elsewhere: Carefully examine all Contract Documents for requirements which affect the work of this Section. Other Specification Sections which directly relate to work of this Section include, but are not limited to following:

1. Concrete: Section 03 30 00 – Cast-In-Place Concrete.
2. Excavation, granular fill setting base and backfill material: Section 31 20 00 – Earth Moving.
3. Landscaping: Section 32 93 00 – Trees, Plants, and Ground Covers.

1.3 QUALITY ASSURANCE; SUBMITTALS

A. Quality Assurance: Conform to requirements of Section 01 33 00 – Submittals Procedures.

B. Submittals: Provide as follows:

1. Product Data:

a. All manufactured equipment.
b. Metal fasteners, anchors, other accessories.

C. Shop Drawings: All items where installation methods are not fully described in product data. Where appropriate, and when approved by the Architect, manufacturer's catalogue cuts may be substituted for shop drawings. LEED Documentation Submittals: Provide the following documentation to the Architect of Record. Refer to and utilize project LEED Letter Templates provided by the Architect of Record for the form and content required for:

1. Credit MR 4: Provide LEED Letter Template and final statement of costs for all recycled content materials.
2. Credit MR 5: Provide LEED Letter Template and final statement of costs for all regional materials.

1.4 REFERENCE STANDARDS

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM):
   A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

B. MDOT: Where specified, comply with applicable provision of State of Maine Department of Transportation Standard Specifications for Highways and Bridges, hereinafter referred to as MDOT.

C. Earthwork: Conform to requirements of Section 31 20 00 – Earth Moving.

PART 2 - PRODUCTS & EXECUTION

2.1 BASIC MATERIALS

A. Reinforcement: ASTM A 615, Grade 60, deformed, hot-dipped galvanized.
1. Provide minimum reinforcement ration of 3 percent.

B. Fasteners and metal components shall be cadmium-plated steel or steel hot-dipped galvanized conforming to:

1. ASTM A 386 for assembled products.
2. ASTM A 153 for iron and steel hardware.

2.2 BASIC INSTALLATION REQUIREMENTS

A. Install all materials and equipment in compliance with manufacturer's recommendations, and as indicated on Drawings.

B. Provide concrete bases and supports as indicated and required.

C. Complete field assembly of site furnishings where required.

2.3 BENCHES

A. Provide as indicated, conforming to manufacturer's specifications:

1. Provide 17" deep x 17 ½" high x 50 ¼" long Arcata Polysite bench by Landscape Forms, Model A-999-06036-EMB.

2. Provide concrete foundation as per drawings.

2.4 PVC SOLID WASTE ENCLOSURE AND FENCE

A. Provide as indicated, conforming to manufacturer's specifications. This work shall include the supply and installation of all PVC fence including posts, gates, fasteners, finishes and ancillary equipment as depicted on the contract drawings or as required to render the installation complete.

B. Acceptable manufacturers include BuffTech by CertainTeed Corporation as distributed by Gorham Fence Co. or equal.

C. All corner and end posts of trash enclosures shall have Schedule 40 galvanized steel inserts. All gate hardware (hinges, latches, handles & pins) shall be galvanized steel.

D. Set all posts in 12" dia. Sonotube filled with concrete.

2.5 ORNAMENTAL FENCES

A. This work shall include the supply and installation of the commercial grade aluminum ornamental fence panels, including posts, fasteners, finishes and all ancillary equipment as depicted on the contract drawings or as required.

1. The fences shall be by Master Halco – Imperial Fence – Style D MOD with black powdercoat finish.

2. Imbed all posts in concrete filled Sonotubes per the details.

2.6 BICYCLE RACK

A. Provide as indicated, conforming to requirements for commercial construction.

1. Provide Dero Bike Hitch, in-ground 2-slot loop bike racks, as manufactured by Dero, www.dero.com, 1-800-298-4915.

2. Constructed of 2-3/8" O.D. galvanized steel pipe.

3. All hardware to be galvanized or stainless steel.

4. Bike rack to be in-ground mounted in concrete foundation with sleeve, clearance as indicated in the detail. Rings shall be positioned perpendicularly to the building wall.

5. Color: Black powdercoat finish.

PART 3 – WARRANTIES

3.1 GENERAL

A. The supplier shall provide warranties on all materials and workmanship for one year excluding vandalism.

B. Site Contractor shall guarantee concrete for one year excluding vandalism.

END OF SECTION 32 30 00

SECTION 32 32 19

CONCRETE MODULAR RETAINING WALL

PART 1 - GENERAL

Work includes furnishing and installing modular block retaining wall units, geogrid reinforcement, wall fill, and backfill to the lines and grades designated on the construction drawings, and as specified herein.

1.1 SECTION INCLUDES

A. Work includes preparing foundation soil, furnishing and installing leveling pad, unit fill, and backfill to the lines and grades designated on the construction drawings.

B. Furnishing and installing all appurtenant materials required for construction of the geogrid reinforced soil retaining wall as required by the manufacturer and as shown on the construction drawings.

C. The work also includes the installation of a 4" diameter underdrain behind the wall.

D. The contractor is solely responsible for safety. The Architect/Engineer and Owner shall not be responsible for means or methods of construction or for safety of workers or of the public.

1.2 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving

B. Section 33 41 00 – Storm Utility Drainage Piping

C. Section 33 46 00 – Subdrainage

1.3 REFERENCE STANDARDS

A. The following most current publications form part of the specification to the extent indicated by references thereto and shall be followed for all construction testing:

ASTM C39	–	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C90	–	85 Hollow Load Bearing Masonry Units
ASTM C136	–	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate
ASTM C140	–	75 Sampling and Testing Concrete Masonry Units
ASTM C145	–	85 Solid Load Bearing Concrete Masonry Units
ASTM D4318	–	Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D1557	–	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

ASTM D4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D5262 – Standard Test Method for Evaluating the Unconfined Creep Behavior of Geosynthetics
ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks)
ASTM D6916 – Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units
AASHTO – Standard Specifications for Highway Bridges
NCMA – "Design Manual for Segmental Retaining Walls" latest edition.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall check the materials upon delivery to assure that proper material has been received.

B. Geogrids shall be stored above –20 Degrees F.

C. Contractor shall prevent excessive mud, wet cement, epoxy, and like materials which may affix themselves, from coming in contact with the materials.

D. Contractor shall protect the material from damage. Damaged material shall not be incorporated into the retaining wall structure.

E. Rolled geogrid material may be laid flat or stood on end for storage.

F. Exposed faces of segmental units shall be reasonably free of chips, cracks, or stains.

1.5 SUBMITTALS

A. Samples of all products used in the work of this section. Available colors and texture shall be provided to the Owner for selection.

B. Latest edition of manufacturer's specifications for proposed materials, method of installation and list of material proposed for use.

C. The design of the wall shall be stamped by a registered professional engineer. The wall shall be designed for highway surcharge (250 pounds per square foot). Lateral earth pressures used for design shall correspond to the design friction angle for the wall backfill material provided on the construction drawings.

D. Submit manufacturer's literature and test data for geogrids to be used in the segmental wall system. Test data shall include connection strength data for segmental units and geogrids to be used determined in accordance with ASTM D6638 as well as geogrid tensile strength and creep data in accordance with ASTM D4595 and ASTM D5262.

E. Submit grain size test results in accordance with ASTM C136 for aggregates to be used for the wall base, for unit fill, and for select reinforced wall backfill (if any).

F. Submit test results on borrow soil to be used for back fill and for the reinforced wall backfill including Atterberg limits, shear test, sieve analysis, and Proctor by ASTM D4318 and ASTM D1557.

1.6 QUALITY ASSURANCE

A. Soil testing and inspection services for quality control testing during earthwork operations are required.

B. Qualifications – The Engineer's approval of the system and the supplier will be based upon the following considerations:

1. The geogrid reinforcement, drainage details, and erosion control system for the system have each been reviewed and approved for use.
2. The supplier has a large enough operation and the necessary experience to supply and support the construction on a timely basis.
3. Past experience in the design and construction of at least 10 projects of a similar magnitude of the modular block wall, rip rap, or gabion substitute can be documented.

C. The design shall be signed by a registered Professional Engineer who shall demonstrate a minimum Errors and Omissions insurance coverage of $2,000,000 by furnishing the Owner with a current certificate of insurance.

D. Pre-Construction Conference – Prior to the installation of the geogrid, the Contractor shall arrange a meeting at the site with the geogrid material supplier and, where applicable, the geogrid installer. The Owner and the Engineer shall be notified at least 3 days in advance of the time of the meeting. The representative of the geogrid supplier shall be available on an "as-needed" basis during construction.

PART 2 - PRODUCTS

2.1 CONCRETE UNITS

A. Masonry units shall be Retaining Wall Units designed to create a modular block wall.

B. Concrete retaining wall units shall have a minimum net 28 day compressive strength of 3,000 psi. The concrete shall have a maximum moisture absorption of 6 to 8 lbs/ft.3.

C. Exterior dimensions may vary in accordance with ASTM C90-85 and be designed for a "random stone" appearance. Standard and Compac units shall have a minimum of 1 square foot face area each. Mini units shall have a minimum ½ square foot face area each.

D. Units shall have angled sides capable of concave and convex alignment curves with a minimum radius of 10 feet. NOTE: Where applicable, for straight walls use non-angled straight side cap units.

E. Units shall be interlocked with non-corrosive fiberglass pins or equal mechanism.

F. Units shall be interlocked as to provide a 6 degree setback per each course of wall height.

G. Dimensional tolerances: ± 1/8" (3 mm) from nominal unit dimensions not including rough split face, ± 1/16" (1.5 mm) unit height – top and bottom planes.

H. Inter-unit shear strength: 600-plf (8 kN/m) minimum at 2-psi (13 kPa) normal pressure.

I. Geogrid/unit peak connection strength: 500-plf (7 kN/m) minimum at 2-psi (13 kPa) normal force.

J. Keystone concrete units shall conform to the following constructability requirements:

1. Vertical setback: 1" (25 mm) + per course per the design;

2. Alignment and grid positioning mechanism - fiberglass pins, two per unit minimum;

3. Maximum horizontal gap between erected units shall be ≤ 1/2 inch (13 mm).

2.2 GEOGRID

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high-density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.

B. Ta, Long Term Allowable Tensile Design Load, of the geogrid material shall be determined as follows:

1. Ta = Tult / (RFcr*RFd*RFid*FS)

2. Ta shall be evaluated based on a 75-year design life.

   a. Tult, Short Term Ultimate Tensile Strength: Tult is based on the minimum average roll values (MARV)
   b. RFcr, Reduction Factor for Long Term Tension Creep: RFcr shall be determined from 10,000-hour creep testing performed in accordance with ASTM D5262. Reduction value = 1.60 minimum.
   c. RFd, Reduction Factor for Durability: RFd shall be determined from polymer specific durability testing covering the range of expected soil environments. RFd = 1.10 minimum.
   d. RFid, Reduction Factor for Installation Damage: RFid shall be determined from product specific construction damage testing performed in accordance with GRI-GG4. Test results shall be provided for each product to be used with project specific or more severe soil type. RFid = 1.05 minimum.
   e. FS, Overall Design Factor of Safety: FS shall be 1.5 unless otherwise noted for the maximum allowable working stress calculation.

C. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

D. Soil Interaction Coefficient, Ci: Ci values shall be determined per GRI:GG5 at a maximum 0.75-inch (19 mm) displacement.

E. Manufacturing Quality Control:

1. The geogrid manufacturer shall have a manufacturing quality control program that includes QC testing by an independent laboratory.

2. The QC testing shall include:

   a. Tensile Strength Testing
   b. Melt Flow Index (HDPE)
   c. Molecular Weight (Polyester)

2.3 FIBERGLASS CONNECTING PINS

A. Connecting pins shall be ½ inch diameter thermoset isopthalic polyester resin/pultruded fiberglass reinforcement rods.

B. Pins shall have a minimum flexural strength of 128,000 psi and short beam shear of 6,400 psi.

C. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to +100 degrees F (-10 to 40 degrees C).

D. Shear connectors shall be capable of holding the geogrid in the proper design position during pre-tensioning and backfilling.

2.4 BASE LEVELING PAD MATERIALS

A. The wall base shall be a high angularity coarse material meeting MDOT 703.12. Wall base material shall consist of 100 percent crushed aggregate, with the following gradation:

US Standard Sieve Size	Percent Passing
25 mm [1 in]	100
19 mm [[¾ in]	60 - 90
12.5 mm [½ in]	10 - 35
9.5 mm [⅜ in]	2 - 15
4.75 mm [No. 4]	0 - 5

B. The contractor may substitute un-reinforced lean concrete with a minimum 28-day compressive strength of 2,500 psi for the granular base material.

2.5 UNIT FILL

A. Unit fill shall be a clean coarse aggregate with high angularity. The unit fill shall be screened 100 percent crushed aggregate or reclaimed masonry, concrete, or bituminous concrete meeting the following gradation:

US Standard Sieve Size	Percent Passing
1-1/2"	100
3/4"	75-100
#4	0-5
#200	< 5

The unit fill shall be placed within cores of and behind units as depicted on approved submittals.

2.6 REINFORCED WALL BACKFILL

A. Reinforced Wall Backfill zone shall extend behind the wall a minimum of 1 ft beyond the back edge of the geogrid reinforcement or the dimension shown on the approved submittal (whichever is larger).

B. Reinforced Wall Backfill shall consist of Compacted Granular Fill, Subbase Material, or Demolished building material that meets the gradation requirements for Compacted Granular Fill or Subbase Material (see Section 31 20 00.2.1).

C. All other backfill behind and in front of the wall shall consist of suitable on-site soil or imported borrow approved by the Geotechnical Engineer. Backfill shall generally consist of sands, silts, or lean clays with a liquid limit less than 45 and a plasticity index less than 20. Fat clay soils, cobbles, and large rock should generally be avoided unless approved by the Geotechnical Engineer based on local practices. Frozen soils, excessively wet or dry soils, debris, and deleterious materials should not be used.

2.7 FILTER FABRIC

A. Filter fabric shall be installed as shown on the plans and shall meet the requirements of Section 31 25 13 of these Specifications.

2.8 DRAINAGE PIPE

A. Drainage pipe shall be 4-inch diameter perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248.

B. The drain pipe should be connected to storm drains or daylighted at low points and/or periodically along the wall alignment.

C. The drain pipe and surrounding drainage course and filter fabric shall be installed in accordance with Section 33 46 00.3.

PART 3 - EXECUTION

3.1 PREPARATION

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Over excavation shall not be paid for and replacement with compacted fill and/or wall system components will be required at contractor expense. Contractor shall be careful not to disturb embankment materials beyond lines shown. Excavate to the base level for a sufficient distance behind the face to permit installation of the base and geogrid reinforcement (if any).

B. Slope or shore excavation as necessary for safety and for conformance with applicable OSHA requirements.

3.2 FOUNDATION SOIL PREPARATION

A. Foundation soil shall be excavated as required for leveling pad dimensions shown on the construction drawings or as directed by the Engineer.

B. Foundation soil shall be examined by the Engineer to assure that the actual foundation soil strength meets or exceeds assumed design strength. Soils not meeting required strength shall be removed and replaced with acceptable material.

C. Over-excavated areas shall be filled with approved compacted granular fill backfill material.

D. Retaining wall subgrade consisting of granular soils (in-situ fill or glacial till) below the building slabs, pavements, and under pavement with a minimum of four passes of a self-propelled vibratory roller or heavy hand-guided vibratory compactor, until firm. Any soft pockets and areas of excess yielding revealed by proof rolling will be removed and replaced with CSF or Subbase Material. Do not proof-roll subgrades consisting of silt/clay soils (marine deposits) or wet or saturated subgrades.

3.3 BASE LEVELING PAD

A. Leveling pad materials shall be placed as shown on the construction drawings, upon undisturbed in-situ soil.

B. Material shall be compacted so as to provide a level hard surface on which to place the first course of units. Material shall be compacted with a minimum of four passes of a self-propelled vibratory roller or heavy hand-guided vibratory plate compactor until firm.

C. Leveling pad shall be prepared to insure complete contact of retaining wall unit with base.

D. Leveling pad materials shall be to the depths and widths shown.

3.4 UNIT INSTALLATION

A. First course of concrete wall units shall be placed on the base leveling pad. The units shall be checked for level and alignment. The first course is the most important to insure accurate and acceptable results. Base block shall be set to accommodate wall batter.

B. Insure that units are in full contact with base.

C. Units are placed side by side for full length of wall alignment. Alignment may be done by means of a string line or offset from base line.

D. Install fiberglass connecting pins and fill all voids at units with unit fill material. Tamp fill.

E. Sweep all excess material from top of units and install next course. Insure each course is completely unit filled, backfilled and compacted prior to proceeding to next course.

F. Lay up each course insuring that pins protrude into adjoining courses above a minimum of one inch. Two pins are required per unit. Pull each unit forward, away from the embankment, against pins in the previous course and backfill as the course is completed. Repeat procedure to the extent of wall height.

G. The top two courses of wall units below the cap shall also have an adhesive or epoxy to provide a permanent bond of the upper blocks.

H. As appropriate where the wall changes elevation, units can be stepped with grade or turned into the embankment with a convex return end. Provide appropriate buried units on compacted leveling pad in area of convex return end.

3.5 CAP INSTALLATION

A. Place Modular Block Cap units over projecting pins from units below. Pull forward to set back position. Back fill and compact to finished grade.

B. As required, provide permanent mechanical connection to wall units with construction adhesive or epoxy. Apply adhesive or epoxy bottom surface of cap units and install on units below.

3.6 GEOGRID INSTALLATION

A. The geogrid soil reinforcement shall be laid horizontally on compacted backfill. Connect to the concrete wall units by hooding geogrid over fiberglass pins. Pull taut, and anchor before backfill is placed on the geogrid.

B. Slack in the geogrid at the wall unit connections shall be removed.

C. Geogrid shall be laid at the proper elevation and orientation as shown on the construction drawings or as directed by the Engineer.

D. Correct orientation (roll direction) of the geogrid shall be verified by the contractor.

E. To pretension geogrid, pull pinned geogrid taut to eliminate loose folds. Stake or secure back edge of geogrid prior to and during backfill and compaction.

F. Follow manufacturer's guideline relative to overlap requirement of uniaxial and biaxial geogrids.

3.7 FILL PLACEMENT

A. Backfill material shall be placed in 8 inch lifts and compacted to 95% of Modified Proctor.

B. Backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack or loss of pretension of the geogrid.

C. Only hand-operated compaction equipment shall be allowed within 3 feet of the back surface of the Modular Block units.

D. Backfill shall be placed from the wall rearward into the embankment to insure that the geogrid remains taut.

E. Tracked construction equipment shall not be operated directly on the geogrid. A minimum backfill thickness of 6 inches is required prior to operation of tracked vehicles over geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

F. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.

G. Fill placed one foot behind the geogrid units shall be wrapped in filter fabric as shown on the plans. A 6" overlap of the filter fabric shall be provided at the top of each layer of stone backfill. An underdrain (4" min.) shall be installed in the stone at the base of the wall.

H. The fill placement shall be coordinated with the installation of handrails, fences, or guiderails.

I. Provide temporary swales to divert runoff away from wall excavation and away from face.

J. Final grade above and below the retaining wall shall provide for positive drainage and prevent ponding. Protect completed wall from other construction. Do not operate large equipment or store materials above the wall that exceed the design surcharge loads.

END OF SECTION 32 32 19

SECTION 32 40 00

SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Provide traffic control signs complying with U.S. Department of Transportation, Federal Highway Administration's "Manual on Uniform on Traffic Control Devices", local codes, and as specified. See Drawings for type, location, and quantity of signs required.

B. Related Sections:

1. Construction Drawings.

2. Manufacturer's Mounting Instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Signs to meet FHWA requirements NCHRP 350 certification, engineer grade reflective.

B. Provide information for all signs, proposed mounting heights, mounting hardware, and posts to be submitted to the Owner for review and approval prior to installation.

C. Posts to meet City of Portland Standards.

2.2 MATERIALS

A. To be backed with Alucobond panels, to be tan or light grey or selected by the Owner. To be painted with reflective baked-enamel finish with following colors:

B. "PEDESTRIAN WAY" Signs: (W11-2a) 24"x24", black symbol on yellow background.

C. Miscellaneous Signs: Per Manual on Uniform Traffic Control Device recommendations or lettered with dimensions shown on the contract drawings.

2.3 POSTS

A. Posts shall be everbright powdercoat, round shape, 2-inch, 14 gauge with stainless steel mounting hardware, with colors as required by the City of Portland.

PART 3 - EXECUTION

A. Conduct an on-site meeting with the Engineer and Owner prior to start of the work to review/confirm sign location and types.

B. Red signs shall be on top where multiple signs are on a single post, larger signs shall be installed above smaller signs.

C. Install weed control collar when signs are installed in turf areas.

D. All signs in pedestrian areas shall be mounted with the bottom of the sign at 7’ above finish grade. Signs in non-pedestrian areas shall be mounted with the bottom of the sign at 5’ above finish grade except ADA signs which shall be 7’. Set posts vertical and plumb as shown in the plans. Mount signs in accordance with manufacturer's instructions. Check mounting height, replace any posts which are not installed plumb.

END OF SECTION 32 40 00

SECTION 32 92 00

TURF AND GRASSES

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the loaming, seeding and sodding as indicated on the Drawings and as specified.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 31 10 00, SITE CLEARING, for topsoil stripping and stockpiling.
2. Section 31 20 00, EARTH MOVING, Establishment of subgrade elevation.
3. Section 32 93 00, TREES, PLANTS, AND GROUND COVERS, Landscaping.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM)

C 136 Sieve Analysis of Fine and Coarse Aggregates
E 11 Wire-Cloth Sieves for Testing Purposes

1.4 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Quantity (lb.)
Topsoil	1
Fertilizer	1

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials if to be used on the project:

Aluminum sulfate
Fertilizer
Lime

C. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Grass seed mix (each)	Commercial fertilizer
Ground limestone	Seed mix for sod

D. Gradation and laboratory analysis:

Topsoil without Admixture
Topsoil with Admixtures

1.5 INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with the requirements of Section 01 45 00 QUALITY CONTROL, to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether material conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification and by the Contractor when they indicate non-compliance.

2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, the Contractor shall provide such auxiliary personnel and services needed to accomplish the testing work and to repair damage caused thereto by the permanent work.

3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

B. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

C. The Contractor shall engage an independent testing agency to perform the following tests and analyses:

Material	Tests and Analysis Required
Topsoil	Mechanical analysis of soil and determination of pH and organic matter content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for seeding and sodding. Organic admixtures shall be provided and blended to provide an average organic content of 8% with a minimum of any test having 6% organic content by dry weight.

1. Materials shall not be used in construction until test results have been reviewed by the Engineer/Landscape Architect.
2. All costs associated with testing shall be at the expense of the Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod:

1. Sod shall not be dug at the nursery or approved source until ready to transport sod to the site of the work or acceptable storage location.

2. Before stripping, sod shall be mowed at a uniform height of 2 in.

3. Cut sod to specified and to standard width and length desired.

B. Transportation of Sod:

1. Sod transported to the Project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury. Closed vehicles shall be adequately ventilated to prevent overheating of the sod.

2. Evidence of inadequate protection following the digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.

3. Sod shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or is in temporary storage.

4. Upon arrival at the temporary storage location or the site of the work, sod material shall be inspected for proper shipping procedures. Should the sod be dried out, the Engineer/Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall at once remove it from the area of the work and replace it with acceptable material.

5. Unless otherwise authorized by the Engineer/Landscape Architect, the Contractor shall notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of sod material. Certificate of Inspection when required shall accompany each shipment.

C. Handling and Storage of Sod:

1. Sod material shall be handled with extreme care to avoid breaking or tearing strips.

2. Sod shall not be stored for longer than 30 hours prior to installation. Sod shall be stored in a compact group and shall be kept moist. Sod shall be prevented from freezing.

3. Sod that has been damaged by poor handling or improper storage will be rejected by the Engineer or Landscape Architect.

D. Deliver seed in original sealed containers, labeled with analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, location of packaging, and name of seed grower. Damaged packages will not be accepted.

E. Deliver fertilizer in sealed waterproof bags, printed with manufacturer's name, weight, and guaranteed analysis.

1.7 PLANTING SEASON

A. Planting season for seeding shall be as follows:

Item	Planting Period	
	Spring	Fall
Grass Seed Mixes	4/15 to 6/15	8/15 to 10/15

B. Planting season for sod shall be as follows:

Item	Planting Period	
	Spring	Fall
Sod	4/15 to 7/1	8/15 to 11/1

C. Planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

D. Planting season may be extended with the written permission of the Engineer/Landscape Architect.

1.8 ACCEPTANCE

A. Acceptance:

1. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

2. Acceptance of material by the Engineer/Landscape Architect will be for general conformance to specified requirements, and shall not relieve the Contractor of responsibility for full conformance to the Contract Documents.

3. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that the work of this Section be accepted.

B. Sod and seed areas will be accepted when in compliance with all the following conditions:

1. Roots are thoroughly knit to the soil;

2. Absence of visible joints (sodded areas);

3. All areas show a uniform stand of specified grass in healthy condition, free of weeds, individual bare spots of over 72 square inches or multiple bar spots in excess of 1 percent of the area.

4. At least 60 days have elapsed since the completion of work under this Section.

PART 2 – PRODUCTS

2.1 SEED

A. Seed shall be of the previous year's crop with 0.5% or less weed seed, and 1.75% or less crop seed, by weight. Seed shall be dry and free of mold. Seed shall meet the following requirements.

B. Seed Mixture:

1. Standard grade seed of the most recent season's crop. Seed shall be dry and free of mold.

2. Seed mixture shall be suitable as follows:

Name of Seed	% by Weight in Mixture	Minimum % Purity	Minimum % Germination
Temporary Seeding Plan			
Perennial Ryegrass	50%	95%	85%
Annual Ryegrass	50%	95%	85%
Low Maintenance Areas			
Tall Fescue	35%	95%	85%
Creeping Red Fescue	30%	95%	85%
Perennial Ryegrass	20%	95%	85%
Annual Ryegrass	15%	95%	85%

2.2 SOD

A. Sod shall be a triplex mixture of hybrid bluegrass. Mixture shall contain approximately equal portions of each hybrid component. Hybrids shall include Cheri Kentucky Bluegrass, Flying Kentucky Bluegrass, Glade Kentucky Bluegrass, Baron Kentucky Bluegrass, or comparable equal bluegrass hybrids.

B. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully, and otherwise maintained from planting to harvest.

C. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 in., plus or minus ¼ in., at the time of cutting. Measurement for thickness shall exclude top growth and thatch.

D. Strip Size: Individual pieces of sod shall be cut to the supplier's standards width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus ½ in. on width, and plus or minus 5% on length. Broken strips and torn and uneven ends will not be acceptable.

E. Strength of Sod Strips: Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.

F. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect its survival.

G. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 36-hour period unless a suitable preservation method is approved prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Engineer/Landscape Architect prior to its installation.

H. Thatch: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

I. Diseases, Nematodes, and Insects: Sod shall be free of diseases, nematodes, and soil-borne insects. State Nursery and Plant Material Laws require that all sod be inspected and approved for sale. The inspection and approval must be made by the State Agricultural Department, Office of the State Entomologist.

J. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds.

2.3 TOPSOIL

A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent available. Additional topsoil required shall be obtained from off-site sources.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam or loam soil as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	**% of Total Weight**	**Average %**
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 m dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.

2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris. All topsoil shall be screened using a 3/8" screen.

3. Organic matter content shall be an average of 8% of total dry weight with a minimum of any sample being 6%.

C. Topsoil shall have a pH value range of 6.0 to 6.5.

1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2. If pH is below desired level add ground limestone. If pH is above desired level add aluminum sulfate.

2.4 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size	% Passing by Weight
No. 10	100
No. 20	90
No. 100	60

2.5 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to seeded or sodded areas.

2.6 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer, and net weight of contents.

2.7 COMMERCIAL FERTILIZER

A. Fertilizer shall conform to the following:

1. When applied as a topsoil amendment, fertilizer shall have an analysis that will deliver appropriate amounts of nitrogen, phosphorus, and potassium as required to remedy deficiencies revealed by testing the topsoil.

2. When used as a top dressing for the maintenance of sod, fertilizer shall conform to the following:

Constituent	% Present by Weight
Nitrogen (N)	10
Phosphorous (P)	0
Potassium (K)	20

a. 50% of nitrogen shall be derived from natural organic source of ureaform.
b. Fertilizer shall be phosphorus-free.
c. Potassium shall be derived from muriate of potash containing 60% potash.

B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.

2.8 MULCHES

A. Straw Mulch: Air-dried, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.9 PESTICIDES, FUNGICIDES

A. General: Pesticide or fungicide 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. Restricted pesticides or fungicides shall not be used unless authorized in writing by authorities having jurisdiction.

PART 3 – EXECUTION

3.1 PREPARATION OF SUBGRADE

A. Subgrade shall be examined to ensure that rough grading and all other subsurface work in lawn areas and other areas to be seeded is done prior to start of seeding and sodding.

B. Existing subgrade shall be loosened or scarified to a minimum depth of 3 in. prior to spreading topsoil. Subgrade shall be brought to true and uniform grade, and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.2 PREPARATION OF TOPSOIL

A. Topsoil shall not be spread until it is possible to follow immediately or within 24 hours with seeding or sodding operations. If topsoil is spread prior to this time it shall be cultivated to loosen soil prior to seeding or sodding.

B. Topsoil shall not be placed when subgrade or topsoil material are frozen, excessively wet, or excessively dry.

C. Topsoil shall be spread in a uniform layer, to a thickness, which will compact to the depth required to bring final lawn and grass surfaces to required elevation. Unless otherwise indicated minimum depth of topsoil shall be 6 in. after compaction.

D. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.3 APPLICATION OF FERTILIZER AND CONDITIONERS

A. Fertilizer and conditioners shall be applied at the following rates:

1. Aluminum Sulfate – as required by test results of topsoil.
2. Limestone - as required by test results of topsoil.
3. Fertilizer - as required by test results of topsoil.
   Suggested rate: 2 pounds active Nitrogen per 1000 square feet.

B. For maintenance of lawn grasses, fertilizer shall be applied at 1 pound active Nitrogen per 1000 square feet. Application frequency: 3 times per year. Apply lime as determined by annual soil tests.

C. Mixing with topsoil:

1. Fertilizer and conditioners shall be spread (and adjust fertilizer frequency requirements) over the entire areas designated at the application rates indicated above.

2. Materials shall be uniformly and thoroughly mixed into the top 4 in. of topsoil by disking, rototilling, or other approved method.

3.4 FINISH GRADING

A. Final surface of topsoil immediately before seeding shall be within ± 1/2 in. of required elevation, with no ruts, mounds, ridges, or other faults, and no pockets or low spots in which water can collect. Stones, roots, and other debris greater than 1 inch in any dimension, which are visible at the surface, shall be removed and the resulting holes filled with topsoil, leaving a uniform planar surface.

B. Finish grade surface with a drag or rake. Round out all breaks in grade, smooth down all lumps and ridges, and fill in all holes and crevices. Rolling with a light roller is acceptable, if the surface is scarified afterward.

C. In the event of settlement, the Contractor shall readjust the work to required finished grade.

3.5 SEED APPLICATION

A. Seed shall be broadcast by means of an approved mechanical slice seeder, to give a uniform application at the following rates:

Seed Application Rate	lb./1,000 S.F.
Temporary Seeding	6.00
Low Maintenance Areas – Alternate to “Other Areas”	6.00

B. Seed shall be applied in two equal applications for uniform coverage; direction of travel of spreader for second pass shall be perpendicular to that of the first pass. Seeding shall not be done when it is raining or snowing, or when wind velocity exceeds 5 mph.

1. At the Contractor's option, and with the permission of the Engineer/Landscape Architect, seed may be spread by the hydroseeding method in areas where slice seeding is not practicable, utilizing power equipment commonly used for that purpose. Seed, lime, fertilizer, and mulch shall be mixed and applied to achieve application quantities specified herein for the conventional seeding method, with mulch applied at the rate of 1,200 lb./acre. Other provisions specified above for conventional seeding shall apply also to hydroseeding.

C. Following seeding the area shall be lightly raked to mingle seed with top 1/8 to 1/4 in. of soil. Area shall then be fine graded. Stones and other debris greater than 1 in. in any dimension which are visible on surface shall be removed. Surface shall be rolled with a hand roller having a weight of 60 to 90 lb./ft. of width, and a minimum diameter of 2 ft.

D. Following seeding and raking, entire area shall be watered by use of lawn sprinklers, or other approved means. Initial watering shall continue until the equivalent of a 2 in. depth of water has been applied to entire seeded surface, at a rate which will not dislodge the seed. Watering shall be repeated thereafter as frequently as required to prevent drying of the surface, until the grass attains an average height of 1 inch. Watering methods and apparatus which may cause erosion of the surface shall not be permitted.

E. On slopes steeper than 1V:3H, erosion control fabric, Curlex I or II by American Excelsior or equal, shall be installed after seeding perpendicular to contours as outlined in Section 31 25 13.

F. Spread straw mulch at the rate of 115#/1,000 sf in areas without erosion control fabric.

3.6 SODDING

A. Edges of the sodded areas shall be smooth, and all sodded areas shall conform to the design cross sections and grade. At edges adjacent to curbs, paved areas, etc., top surface of earth in sod shall be 1/2 in. below adjacent hard surface.

B. Sod shall be placed and all sodding operations completed within 72 hours following stripping from sod source bed.

C. On slopes steeper than 2 to 1, sod shall be fastened in place with suitable wood pins or other approved methods, spaced at not less than 1 pin per square foot.

D. Surface of completed sodded area shall be smooth. Sod shall be laid edge-to-edge, with tight-butted, staggered joints. Sod shall be carefully placed to insure that it is neither stretched or overlapped. Immediately after laying sod shall be pressed firmly into contact with sod bed by tamping or rolling, to eliminate air pockets. Following compaction, topsoil shall be used to fill all cracks, and excess soil shall be worked into grass with rakes or other suitable equipment. Sod shall not be smothered with excess fill soil.

E. Immediately after sodding operations have been completed, entire surface shall be compacted with a cultipacker roller or other approved equipment weighing 100 to 160 lb./ft. of roller.

F. Completed sod shall immediately be watered sufficiently to uniformly wet the soil to at least 1 in. below the bottom of sod bed.

3.7 MAINTENANCE

A. Except as otherwise specified below, maintenance shall include all operations required to produce an established lawn, including but not limited to: Fertilizing, resodding, mowing, weeding, watering, or reseeding.

B. Maintenance of seeded areas shall begin upon completion of seeding or and shall continue until full turf establishment and acceptance of the lawn or seeded area, until mowing as specified below is completed, or until average height of grass is 1-1/2 in., whichever occurs later.

C. Maintenance of sodded areas shall begin upon completion of sodding and shall continue for 45 days thereafter, unless sodding is not completed until after September 15, in which case maintenance shall continue until the June 15 following.

D. After grass has sprouted, seeded areas, which fail to show a uniform stand of grass shall be replanted as often as necessary to establish an acceptable stand of grass.

1. Scattered bare spots, shall not exceed 50 sq. in. each.
2. Multiple bare spots shall not exceed 5 sq. ft. within a 500 sq. ft. area.

E. First mowing shall be done when average height of grass is 3 in., with mower set to cut at a height of 2 in. Subsequent mowings shall be made at not over one week intervals, with the height of cut set at 2 in. With prior permission of the Owner, mowings during periods of slow growth or dormancy may be spaced at greater intervals.

F. If lawn or grass is established in the fall and maintenance is required to continue into spring months, lawn and grass shall receive an application of lime and fertilizer in the spring. Lime and fertilizer shall be spread in a uniform layer over the entire lawn surface, at the rates recommended by a soil test administered at that time.

3.8 PAYMENTS

A. Payment for loam & seed shall be as follows:

- 50% after all loam has been placed and initial seeding.
- 25% after three mowings, fertilizer, and weed killer applied.
- 25% after acceptance by the Owner.

END OF SECTION 32 92 00

SECTION 32 93 00

TREES, PLANTS, AND GROUND COVERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all materials and equipment, and do all work required to complete the planting, as indicated on the Drawings and as specified.

1.2 RELATED WORK

A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 31 10 00 – SITE CLEARING. Clearing and grubbing, and stripping of topsoil.
2. Section 31 20 00 – EARTH MOVING. Establishment of subgrade elevations and excavation and backfill.
3. Section 32 92 00 – TURF AND GRASSES. Seeding and sodding.

1.3 REFERENCES

A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American National Standards Institute, Inc. (ANSI):

Z60.1	American Standard for Nursery Stock (Sponsor: American Association of Nurserymen, Inc.)

2. American Society for Testing and Materials (ASTM):

C 136	Sieve Analysis of Fine and Coarse Aggregates
E 11	Wire-Cloth Sieves for Testing Purposes

3. American Wood Preservers' Association (AWPA):

C2	Lumber, Timbers, Bridge Ties and Mine Ties – Preservative Treatment By Pressure Processes

4. "Hortus Third", A Concise Dictionary of Plants Cultivated in the United States and Canada, Cornell University, L.H. Bailey Hortorium, MacMillian Publishing Co., New York, NY.

1.4 SUBMITTALS

A. Samples: The following samples shall be submitted:

Material	Sample Size or Quantity (lb)
Mulch	1
Planting soil	1
Topsoil from on-site sources	1
Topsoil from off-site sources	1
Each plant species	Actual representative sample, or picture with scale; include information on sources

B. Manufacturer's Product Data: Manufacturer's product data shall be submitted for the following materials:

Aluminum sulfate
Antidessicant
Fertilizer
Fungicide
Insecticide
Compost

C. Certificates: Labels from the manufacturer's container certifying that the product meets the specified requirements shall be submitted for the following materials:

Compost
Commercial fertilizer
Limestone

D. Test Reports: Test reports from an approved testing agency indicating compliance with the specifications shall be submitted for topsoil, planting soil mixture, and any other materials designated by the Engineer/Landscape Architect.

1.5 OWNER'S INSPECTION AND TESTING

A. Work will be subject to inspection at all times by the Engineer/Landscape Architect. The Owner reserves the right to engage an independent testing laboratory in accordance with requirements of Section 01 45 00, QUALITY CONTROL to analyze and test materials used in the construction of the work. Where directed by the Engineer/Landscape Architect, the testing laboratory will make material analyses and will report to the Engineer/Landscape Architect whether materials conform to the requirements of this specification.

1. Cost of tests and material analyses made by the testing laboratory will be borne by the Owner when they indicate compliance with the specification, and by the Contractor when they indicate non-compliance.

2. Testing equipment will be provided by and tests performed by the testing laboratory. Upon request by the Engineer/Landscape Architect, shall provide such auxiliary personnel and services needed to accomplish the testing work.

3. Gradation of granular materials shall be determined in accordance with ASTM C 136. Sieves for determining material gradation shall be as described in ASTM E 11.

1.6 CONTRACTOR'S INSPECTION AND TESTING

A. Testing, analyses, and inspection required by the Contractor for his own information or guidance shall be at his own expense.

B. The Contractor shall engage an independent testing agency, experienced in the testing of agricultural soils and acceptable to the Engineer/Landscape Architect, to perform the following tests and analyses:

Material	Tests and Analysis Required
Topsoil	Mechanical analysis of soil indicating the percent passing by weight of the following sieve sizes: 1 in., 1/2 in., No. 4, No. 10, No. 100, and No. 200. Determination of pH, organic content, and nutrient content. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring nutrient content and pH to satisfactory levels for planting.
Compost	Determination of moisture absorption capacity, organic matter content, and pH.

1. Materials shall not be used in construction until test results have been reviewed by the Engineer/Landscape Architect.

2. All costs associated with testing shall be at Contractor's expense.

1.7 SOURCE QUALITY CONTROL

A. Identification of plant names shall be as listed in "Hortus Third".

B. Selection of Plant Materials: Submit to the Engineer/Landscape Architect the names and locations of nurseries proposed as sources of acceptable plant material. Inspect all nursery materials to determine that the materials meet the requirements of this section. Proposed materials shall be flagged at the nurseries by the Contractor prior to viewing by the Engineer/Landscape Architect.

1. Schedule with the Engineer/Landscape Architect a time for viewing plant material at the nursery. Trips to nurseries shall be efficiently arranged to allow Engineer/Landscape Architect to maximize his viewing time. A minimum of six weeks shall be allowed for this viewing prior to time that plants are to be dug.

2. Engineer/Landscape Architect may choose to attach his seal to each plant, or representative samples.

3. Where requested by the Engineer/Landscape Architect, photographs of plant material or representative samples of plants shall be submitted.

4. Viewing and/or sealing of plant materials by the Engineer/Landscape Architect at the nursery does not preclude the Engineer/Landscape Architect's right to reject material at the site of planting.

1.8 UNAVAILABILITY OF PLANT MATERIALS

A. No changes or substitutions may be made without prior approval by the Engineer/Landscape Architect, and municipal authority, if applicable. If unavailability of plant material becomes a concern, then submit satisfactory evidence of advertisement for a one month period in a field-related trade journal or online, without success, or submit written substantiation that specific material is unavailable from at least six reliable and approved sources. Provide alternative availability data or substitution recommendations for approval prior to purchase and installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Digging Plant Material: Plants shall not be dug at the nursery or approved source until the Contractor is ready to transport them from their original locations to the site of the work or acceptable storage location.

B. Transportation of Plant Material: Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants.

1. Plants shall be kept moist, fresh, and protected at all times. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.

2. The roots of bareroot stock shall be protected from drying out with wet straw or other suitable material while in transit.

3. Unless otherwise authorized by the Engineer/Landscape Architect, notify the Engineer/Landscape Architect at least two working days in advance of the anticipated delivery date of any plant material. A legible copy of the bill of lading, showing the quantities, kinds, and sizes of materials included for each shipment shall be furnished to the Engineer/Landscape Architect.

C. Storage: Unless specific authorization is obtained from the Engineer/Landscape Architect, plants shall not remain on the site of work longer than three days prior to being planted.

1. Plants that are not planted immediately shall be protected as follows:

a. Earth balls shall be kept moist and their solidity carefully preserved.

b. Plants shall not be allowed to dry out or freeze.

2. Bareroot plants may remain on the site of the work only 24 hours before being planted or placed in storage. During this 24-hour period, injury and desiccation of plants on-site shall be prevented.

a. Roots of plants in storage shall first be puddled in a paste solution of prepared planting soil and then watered.

b. Plants shall then be protected and kept moist by "heeling-in" the roots or by placing the plant in a cool moist storage building. The "heeling-in" procedure shall require the plants to be separated and the roots heeled in a suitable moist soil. If plants are stored in a building, the roots shall be covered with suitable moist mulch.

3. Both the duration and method of storage of plant materials shall be subject to the approval of the Engineer/Landscape Architect.

D. Handling of Plant Materials: Exercise care in handling plant materials to avoid damage or stress.

1.10 REJECTION OF MATERIALS

A. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage, shall be cause for rejection.

B. Upon arrival at the temporary storage location or the site of the work, plants shall be inspected for proper shipping procedures. Should the roots be dried out, large branches be broken, balls of earth broken or loosened, or areas of bark be torn, the Engineer/Landscape Architect will reject the injured plant.

C. When a plant has been rejected, remove it from the area of the work and replace it with one of the required size and quality at no extra expense to the Owner.

1.11 PLANTING SEASON

A. Coordinate plantings to be placed on the rip rapped slope with the work of others. Planting of these plants will be required in advance of the majority of the landscaping.

B. Spring Planting: Spring planting may commence as soon as the ground has thawed at the nursery and at the site of planting, and weather conditions make it practicable to work both at the nursery and at the site. The planting period shall be April 1 to October 15.

C. Regardless of the dates specified above, planting shall only be performed when weather and soil conditions are suitable for planting the material specified in accordance with locally accepted practice.

D. Planting season may be extended only with the written permission of the Engineer/Landscape Architect.

1.12 ACCEPTANCE

A. The Engineer/Landscape Architect will inspect all work for Substantial Completion upon written notice of completion. The request shall be received at least ten calendar days before the anticipated date of inspection.

B. Acceptance of plant material by the Engineer/Landscape Architect will be for general conformance to specified size, character, and quality, and shall not diminish responsibility for full conformance to the Contract Documents.

C. Upon completion and reinspection of all repairs or renewals necessary in the judgment of the Engineer/Landscape Architect, the Engineer/Landscape Architect will recommend to the Owner that acceptance of the work of this Section be given.

D. Acceptance in Part

1. The work may be accepted in parts when it is deemed to be in the Owner's best interest to do so, and when permission is given to the Contractor in writing to complete the work in parts.
2. Acceptance and use of such areas by the Owner shall not waive any other provisions of this Contract.

1.13 MAINTENANCE

A. Plant material shall be maintained until the completion of guarantee period and Final Acceptance of work, as described in Part 3 of this Section.

B. Following Acceptance, maintenance of plant material shall become the Owner's responsibility. Provide instructions and service as follows.

1. Provide Owner with typewritten recommended maintenance program at time of Substantial Completion.

2. Make as many periodic inspections as necessary during the guarantee period, at no additional cost to the Owner, to inspect the condition of all plant materials. Submit written report of each inspection to the Engineer/Landscape Architect outlining corrective measures required to keep the guarantee valid.

1.14 GUARANTEE

A. Plants shall be guaranteed for a period of one year after the date of Acceptance by the Owner and Engineer/Landscape Architect.

1. When the work is accepted in parts, the guarantee periods shall extend from each of the partial acceptances to the terminal date of the last guarantee period. Thus, all guarantee periods terminate at one time.

B. Plants shall be healthy, free of pests and disease, and in flourishing condition at the end of the guarantee period. Plants shall be free of dead and dying branches and branch tips, and shall bear foliage of normal density, size, and color.

C. Replace dead plants and all plants not in a vigorous, thriving condition, as determined by the Engineer/Landscape Architect during and at the end of the guarantee period, without cost to the Owner, as soon as weather conditions permit and within the specified planting period.

1. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this Specification.

2. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.

3. The guarantee of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended guarantee period, the Owner may elect one more replacement or credit for each item.

D. At the end of the guarantee period, and no less than five days prior to final inspection, staking and guying materials, and tree wrap and ties shall be removed from the site.

1.15 FINAL INSPECTION AND FINAL ACCEPTANCE

A. At the end of the guarantee period, the Engineer/Landscape Architect will, upon written notice of end of guarantee period inspect the work for Final Acceptance. Request shall be received at least ten calendar days before the anticipated date for Final Inspection.

B. Upon completion and reinspection of full repairs or replacements necessary in the judgment of the Engineer/Landscape Architect at that time, the Engineer/Landscape Architect will recommend to the Owner that Final Acceptance of the Work of this Section be given.

PART 2 - PRODUCTS

2.1 PLANTS

A. Except as otherwise specified, size and grade of plant materials shall conform to ANSI Z60.1. In no case shall ball size be less than 11 in. in diameter for each inch of caliper.

B. Plants shall have outstanding form; symmetrical, heavily branched with an even branch distribution, densely foliated and/or budded, and a strong, straight, distinct leader where this is characteristic of species. Plants shall possess a normal balance between height and spread. The Engineer/Landscape Architect will be the final arbiter of acceptability of plant form.

C. Plants shall be healthy and vigorous, free of disease, insect pests and their eggs, and larvae.

D. Plants shall have a well-developed fibrous root system.

E. Plants shall be free of physical damage such as scrapes, broken or split branches, scars, bark abrasions, sunscalds, fresh limb cuts, disfiguring knots, or other defects. These defects shall not interrupt more than 25% of the circumference of the plant cambium.

F. Plants shall meet the sizes indicated on the Plant List. Plants larger or smaller than specified may be used only if accepted by the Engineer/Landscape Architect.

G. Where a size or caliper range is stated, at least 50% of the material shall be closer in size to the top of the range stated.

H. Plants shall not be pruned before delivery.

I. Plants indicated as "B&B" shall be balled and burlapped.

1. Unless otherwise permitted by the Engineer/Landscape Architect, plants shall be nursery grown.

2. Plants shall be grown for at least two years under climatic conditions similar to those in the locality of the Project.

3. Nursery grown plants shall be freshly dug. No heeled in plants or plants from cold storage will be accepted, unless otherwise permitted by the Engineer/Landscape Architect.

J. Container grown plants shall be well rooted and established in the container in which they are growing. They shall have grown in the container for a sufficient length of time for the root system to hold the planting medium when taken from the container, but not long enough to become root bound. Container grown plants exceeding the sizes indicated in ANSI Z60.1 shall have containers which are not less than 75% of the ball sizes for comparable B&B plant material. Each container plant shall be inspected and root pruned as needed.

1. Canes or Trunk(s) and Branches:

a. Very well formed and sturdy.
b. Branching plentiful and uniformly distributed to form a well-balanced plant.
c. Scars shall be free of rot and not exceed 1/4 the diameter of the wood beneath in greatest dimension unless completely healed (except pruning scars).
d. Pruning scars clean cut leaving little or no protrusion from the trunk or branch.
e. Graft union completely healed.
f. No mechanical or pest damage.
g. No extreme succulence.

2. Foliage:

a. Densely supplied with healthy, vigorous leaves of normal size, shape, color, and texture (except shrubs moved bare-root or deciduous shrubs when dormant).
b. No holes, cavities, or depressed areas caused by broken or dead branches or insufficient foliage.
c. No chlorosis.
d. Pest or mechanical damage barely perceptible with no more than 5% of total foliage affected.
e. No frost or cold damage discernible.

3. Root System:

a. Sturdily established in container.
b. Shall not be excessively rootbound except plants deliberately grown rootbound to produce a dwarf plant.
c. No large roots growing out of container.
d. Noxious weeds in container.

K. Bareroot stock, where specified or approved by Engineer/Landscape Architect, shall meet the standards of ANSI Z60.1 and shall conform to the following:

1. Root System. The root system of bareroot stock shall be sufficient to insure plant growth.

2. Bareroot Trees. Bareroot trees shall have a heavy fibrous root system that has been developed by proper cultural treatment, transplanting, and root pruning. The spread of the root system shall be 12 times greater than the trunk diameter plus an additional 6 in.

3. Bareroot Shrubs. Bareroot shrubs shall have a well-developed fibrous root system, with a minimum spread conforming to the following:

Plant Height, ft.	Minimum Spread of Roots, in.
1.5 to 2	10
2 to 3	11
3 to 4	14
4 to 5	16
5 to 6	18
6 to 8	20

2.2 TOPSOIL

A. Topsoil shall be obtained from a previously established stockpile on the site, to the extent that suitable material is available. Additional topsoil required shall be obtained from off-site sources.

B. Topsoil, whether stripped from site or supplied from off-site, shall be a sandy loam as defined by the USDA Soil Conservation Service, Soil Classification System, and shall have the following mechanical analysis:

Textural Class	% of Total Weight	Average %
Sand (0.05-2.0 mm dia. range)	45 to 75	60
Silt (0.002-0.05 mm dia. range)	15 to 35	25
Clay (less than 0.002 mm dia. range)	5 to 25	15

1. 95% of topsoil shall pass a 2.0 mm sieve.

2. Topsoil shall be free of stones 1 in. in longest dimension, earth clods, plant parts, and debris.

3. Organic matter content shall be 4 to 12% of total dry weight.

2.3 COMPOST

A. Compost shall be highly organic dark brown to black containing 6-10% organic matter tested on a dry weight basis with pH between 6.0 – 8.0, free of plants, their roots, debris; other extraneous matter >1 in. diameter and shall be uncontaminated by foreign matter, or substances harmful to plant growth. Do not use soil for planting while in a frozen or muddy condition.

2.4 PLANTING SOIL

A. Planting soil shall be a mixture of 3 parts topsoil and 1 part compost, by volume.

B. Planting soil shall have pH value range of 5.5 to 7.0

1. If planting soil mixture does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2.5 LIMESTONE

A. Ground limestone shall be an agricultural limestone containing a minimum of 85% total carbonates, by weight. Ground limestone shall be graded within the following limits:

Sieve Size%	Passing by Weight
No. 10	100
No. 20	90
No. 100	60

2.6 WATER

A. Water shall be suitable for irrigation and shall be free from ingredients harmful to plant life.

2.7 ALUMINUM SULFATE

A. Aluminum sulfate shall be unadulterated and shall be delivered in containers with the name of the material and manufacturer and net weight of contents.

2.8 COMMERCIAL FERTILIZER

A. Fertilizer content shall conform to the following:

Constituent	% Present by Weight
Nitrogen (N)	10
Phosphorus (P)	0
Potassium (K)	10

1. 50% of nitrogen shall be derived from natural organic source of ureaform.

2. Fertilizer shall be phosphorus-free.

3. Potassium shall be derived from muriate of potash containing 60% potash.

B. Fertilizer shall be delivered in manufacturer's standard container printed with manufacturer's name, material weight, and guaranteed analysis.

C. Fertilizers with N-P-K analysis other than that stated above may be used provided that the application rate per square foot of nitrogen, phosphorus, and potassium is equal to that specified.

D. Controlled-release fertilizer shall be equal to the following:

Product	Manufacturer
Agriform 20-10-5	Sierra Chemical Co.
Planting Tablets	Milpitas, CA 95035
EZY-Grow Fertilizer Packet	EZY-Grow - Landscape Specialties

Phosphorus-free controlled-release fertilizer is preferred, if available.

E. Slow release fertilizer for seasonal plantings shall be Osmocote slow release 14-14-14 analysis (or preferred phosphorus-free).

2.9 MULCH

A. Mulch shall be a 100% fine-shredded pine bark, of uniform size and free from rot, leaves, twigs, debris, stones, or any material harmful to plant growth. Bark shall have been shredded and stockpiled no less than two months and no more than two years before use.

2.10 GUYING AND STAKING MATERIALS

A. Wood Stakes: For trees under 10 ft. in height, straight, sound, rough sawn lumber not less than 2 x 2 in., if square, or 2-1/2 in. diameter, if round. Wire for staking shall be 12-gauge steel or polyethylene ties per the detail.

B. Wire for Guying: Galvanized steel 1 x 19 preformed 3/16 in. diameter.

C. Turnbuckles: Galvanized steel fitted with eyebolts.

D. Deadman: Sound, rough sawn lumber 2 x 4 in., or other material approved by the Engineer/Landscape Architect.

E. Hose: High quality braided rubber hose, 3/4 in. diameter and suitable length, black in color.

2.11 ANTIDESICCANT

A. Antidesiccant shall be an emulsion specifically manufactured for plant protection which provides a protective film over plant surfaces which is permeable enough to permit transpiration. Antidesiccant shall be delivered in manufacturer's sealed containers and shall contain manufacturer's printed instructions for use.

B. Antidesiccant shall be equal to the following:

Product	Manufacturer
Wilt-Pruf	Wilt-Pruf Products, Inc. P.O. Box 469 Essex, CT 06426

2.12 FUNGICIDE

A. General: Chemicals 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 chemicals unless authorized in writing by authorities having jurisdiction.

1. Fungicide shall be zinc ethylene bisdithiocarbonate (Zineb), or equal.

2.13 EROSION CONTROL MESH

A. Open weave, biodegradable erosion control mesh for use on planted slopes steeper than 1V:3H, as recommended below:

Slope Steepness	Type
≤ 3H:1V	Curlex I by American Excelsior or equal
≤ 1.5H:1V	Curlex II by American Excelsior or equal

PART 3 - EXECUTION

3.1 EXAMINATION OF SUBGRADE

A. Examine subgrade and rough grading before planting. Alert Engineer/Landscape Architect to unacceptable rough grading or subgrade.

3.2 DRAINAGE OF SOILS

A. Test drainage of five plant beds and pits chosen by the Engineer/Landscape Architect shall be done by filling with water twice in succession. The time at which water is put into the pit or bed for a second filling shall be noted. Engineer/Landscape Architect shall then be notified of the time it takes for pit or bed to drain completely. Planting operations shall not proceed until Engineer/Landscape Architect has reviewed test drainage results.

B. Notify the Engineer/Landscape Architect in writing of all soil or drainage conditions that he considers detrimental to growth of plant material. Submit proposal and cost estimate for correction of the conditions for Engineer/Landscape Architect 's approval before starting work.

3.3 LAYOUT OF PLANTING AREAS

A. Individual plant locations and outlines of shrub and ground cover areas to be planted shall be staked by the Contractor in ample time to allow inspection by the Engineer/Landscape Architect.

B. Digging shall not begin until locations are approved by the Engineer/Landscape Architect.

C. Location of trees shall be staked using color-coded stakes. A different stake color shall be used for each tree species.

3.4 PREPARATION OF SUBGRADE

A. Subgrade of planting areas shall be loosened or scarified to a minimum depth of 3 in. prior to spreading planting soil. Subgrade shall be brought to true and uniform grade and shall be cleared of stones greater than 2 in., sticks, and other extraneous material.

3.5 PLANT PIT EXCAVATION

A. Planting pits for trees and shrubs shall be excavated to the depth and dimension indicated on the Drawings.

B. Excavation shall not begin until locations are approved by the Engineer/Landscape Architect.

3.6 FILTER FABRIC

A. Filter fabric shall be installed where indicated on the Drawings. Unless otherwise indicated on the Drawings, filter fabric shall be overlapped 6 in. along all edges.

3.7 SPREADING OF PLANTING SOIL

A. Planting soil shall be spread and placed to required depths.

B. Surfaces shall be graded and smoothed, eliminating all sharp breaks by rounding, scraping off bumps and ridges, and filling in holes and cuts.

3.8 PLANTING

A. Walls of plant pits shall be dug so that they are vertical and scarified.

B. Plants shall be set as indicated on Drawings. Plants shall have same relationship to finished grade as in the nursery.

C. Plants shall be turned to the desired orientation when required by Engineer/Landscape Architect.

D. Containerized plants shall be removed from container taking care not to damage roots. The side of the root ball shall be scarified to prevent root-bound condition and plant positioned in planting pit.

E. Planting shall be positioned in center of planting pit, set plumb, and rigidly braced in position until all planting soil has been tamped solidly around the ball.

F. Pits for shrubs shall be backfilled with planting soil. Tree pits shall be backfilled with existing soil mixed with existing topsoil, no planting soil. Soil shall be worked carefully into voids and pockets, tamping lightly every 6 in.

1. When pit is two-thirds full, plants shall be watered thoroughly, and water left to soak in before proceeding.

2. At this time, ropes or strings on top of ball shall be cut and removed. Burlap or cloth wrapping shall be completely removed once plant is set in pit. Non-biodegradable ball wrapping and support wire shall be totally removed from ball and planting pit.

3. Remove nursery plant identification tags.

G. Backfilling and tamping shall then be finished and a saucer formed around plant pits as indicated on the Drawings.

H. Saucer shall be filled with water and water left to soak in. Saucer shall then be filled with water again.

I. Following planting of aquatic plant material, 3 in. layer of gravel shall be spread to stabilize soil beneath.

3.9 BULBS AND HERBACEOUS PERENNIALS

A. Prepare perennial planting beds by application of fertilizers and pH-altering amendments and thoroughly rototilling into the top 12 in. prior to planting bulbs and flowering plants.

3.10 APPLICATION OF FERTILIZER

A. Fertilizer shall be applied when planting pits are backfilled two-thirds full. Fertilizer application shall be of the type, rate, and timing recommended by the testing agency for each plant type.

B. Slow-release fertilizer

1. Fertilization schedule for trees and shrubs using slow release 4 oz. packet system shall be per manufacturer's recommendations.

2. Fertilizer packets shall be placed 6 to 8 in. deep below top of planting soil around root balls of plants. Packets shall be spaced evenly depending on the number of packets required.

3.11 FUNGICIDE SPRAYING

A. Immediately after planting, all trunks of deciduous trees shall be sprayed with fungicide, applied as directed by chemical manufacturer.

3.12 STAKING AND GUYING

A. Each tree shall be staked or guyed immediately following planting. Plants shall stand plumb after staking or guying.

B. Duckbill Tree Support Systems shall be installed in strict conformance with manufacturer's published installation instructions.

C. Duckbill Root Ball Fixing Systems shall be installed in strict conformance with manufacturer's published installation instructions.

3.13 EROSION CONTROL JUTE MESH

A. Install material perpendicular to contours on slopes steeper than 1V:3H. Overlap edges 6" and pin with galvanized metal pins every 12". Tuck top edge under soil and cover with 6" topsoil. X-cut openings to dig plant pots and replace mesh after watering in the plant cover with mulch.

3.14 MULCHING

A. Mulch shall be applied as follows (entire area listed shall be mulched):

Plant Type	Mulch Area	Mulch Depth, in.
Tree	Saucer	3
Shrub	Saucer or Bed	3
Groundcover	Bed	3

3.15 PRUNING

A. Each tree and shrub shall be pruned to preserve the natural character of the plant. Pruning shall be done after delivery of plants and after plants have been inspected and approved by the Engineer/Landscape Architect. Pruning procedures shall be reviewed with Engineer/Landscape Architect before proceeding.

B. Pruning shall be done with clean, sharp tools. Cuts shall be made flush, leaving no stubs. No tree paint shall be used.

C. Dead wood, suckers, and broken and badly bruised branches shall be removed.

3.16 MAINTENANCE OF PLANTING

A. Maintenance shall begin immediately after each plant is planted and shall continue until Final Acceptance. The Contractor shall provide water for irrigation if none is available on site.

B. Maintenance shall consist of pruning, watering, cultivating, weeding, mulching, removal of dead material, repairing and replacing of tree stakes, tightening and repairing of guys, resetting plants to proper grades and upright position, and furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, and in a healthy growing condition.

C. Planting areas shall be kept free of weeds, grass, and other undesired vegetative growth.

D. Note: Extend maintenance beyond Substantial or Final Acceptance of Project if necessary to meet above requirements. Engineer/Landscape Architect may withhold funds from Substantial and Final Completion payments as necessary to assure proper performance of maintenance operations.

END OF SECTION 32 93 00

SECTION 33 11 00

WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the water systems. This shall include, but not be limited to the following: pipe and fittings for site water line including domestic water line and fire water line, valves, set lines, elevations, and grades for water distribution systems work and control system for duration of work including careful maintenance of benchmarks, property corners, monuments, or other reference points.

B. Meter and backflow devices are to be supplied by the General Building Contractor to meet the requirements of the Portland Water District.

1.2 RELATED SECTIONS

A. Section 31 20 00 – Earth Moving

B. Section 32 11 00 – Base Courses

C. Section 33 39 00 – Sewer Appurtenances

D. Local Governing Authority and Code Requirements.

E. All Necessary Construction Permits.

E. The public utility for water is the Portland Water District. All materials, installation, and workmanship will comply with the requirements specified in this section, the requirements of the Public Utilities Commission and the Portland Water District. Where a more stringent standard exists, the more stringent standard shall apply.

1.3 REFERENCE

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 Kg) Rammer and 18-in. (457 mm) Drop

C. ANSI/ASTM D2466 - Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

D. ANSI/AWS A5.8 - Brazing Filler Metal.

E. ANSI/AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe Fittings for Water.

F. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquid.

G. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

H. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

I. ANSI/AWWA C500 - Gate Valves, 3 through 48 in NPS, for Water and Sewage Systems.

J. ANSI/AWWA C502 - Dry Barrel Fire Hydrants.

K. ANSI/AWWA C504 - Rubber Seated Butterfly Valves.

L. ANSI/AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in through 24 in NPS.

M. ANSI/AWWA C509 - Resilient Seated Gate Valves 3 in through 12 in NPS, for Water and Sewage Systems.

N. ANSI/AWWA C600 - Installation of Ductile-Iron Water Mains and Appurtenances.

O. ANSI/AWWA C606 - Grooved and Shouldered Type Joints.

P. ANSI/AWWA C900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water.

Q. ASTM B88 - Seamless Copper Water Tube.

R. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.

S. ASTM D2241 - Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).

T. ASTM D2855 - Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.

U. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

V. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

W. ASTM D3139 - Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

Z. ASTM D3035 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

AA. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, ½ inch through 3 inch, for water.

BB. UL 246 - Hydrants for Fire - Protection Service.

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, hydrants, valves and accessories including ASTM designations, AWWA certifications and UL labels as required.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with utility company and/or municipality requirements.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

PART 2 - PRODUCTS

2.1 PIPE

A. Pipe sizes less than 3" that are installed below grade and outside building shall comply with the following:

1. Seamless Copper Tubing: Type "K" roll form to comply with ASTM B88-62. Fittings shall be brass compression manufactured by Ford, Mueller, or McDonald.

B. Pipe: Sizes 4" and larger shall comply with the following:

1. Ductile Iron Water Pipe: In accordance with ANSI A21.51. (AWWA C151) ductile iron pipe shall be cement mortar lined in accordance with AWWA C104. Joints shall meet requirements of AWWA C111. Push-on joint pipe to be supplied with gaskets and gasket lubricants. Pipe shall be 62-42-10 strength; 60,000 psi minimum tensile strength; 42,000 psi minimum yield strength; 10 but not including 12 inch shall have a Class 52 wall thickness. Size 12" and over shall have Class 51 wall thickness. The bituminous coating used for the

sealing of the cement mortar lining shall be of a quality that will not have a deleterious effect on the quality, color, taste or odor of potable water.

C. Ductile Iron Fittings: Fittings shall be manufactured by Tyler or Griffin and material shall be ASTM A536-72 mini grade 70-50-05, in accordance with AWWA C110. Fittings shall be cement lined (AWWA C104-74). Interior seal coated (AWWA C104-74) and exterior bituminous coated. Mechanical joint with accessories furnished; D.I. glands, gaskets, Cor-Ten T-bolts and nuts; Class 350 pressure rating in accordance with AWWA C110. Thickness shall be equal to ductile iron pipe Class 53 in accordance with AWWA C151. All plain end fittings shall be beveled-edged (60^{O}) to fit slip-joint fitting and shall be long body design.

D. Retainer Glands: Glands shall be heavy duty ductile iron body as manufactured be Romac or Ebba Iron and shall have a minimum working pressure rating as follows:

1) 4" - 350 psi (pounds per square inch)
   6" - 350 psi
   8" - 250 psi
   12" - 200 psi

Set screws shall be:

1) cupped style ends;
2) composed of Cor-Ten Steel or Ductile Iron

The number of set screws shall be equal to or greater than the number of inches of nominal diameter of the gland (i.e. 4" - 4 set screws; 6" - 6 set screws, etc.).

Gland shall meet AWWA specifications.

E. Bolts and Nuts: General description of properties required.

1. Stainless Steel: Type 316 - contains the addition of molybdenum to the nickel-chromium steels.

Specific Chemical Composition:

a)	Carbon	-	0.08% max.
b)	Manganese	-	2.00% max.
c)	Silicone	-	1.00% max.
d)	Phosphorus	-	0.04% max.
e)	Sulphur	-	0.03% max.
f)	Chromium	-	16-18.00%
g)	Nickel	-	10-14.00%
h)	Molybdenum	-	2-3.00%
i)	SAE No.	-	30316
j)	ASM No.	-	5361A, 5524A, 5573, 5648B, 5690D

2. Cor-Ten Steel: Trade name for cold formed T-head bolts containing alloying elements such as copper, nickel, and chrome.

   Specific Chemical Composition:

a)	Carbon	-	0.2% max.
b)	Manganese	-	1.25% max.
c)	Sulphur	-	0.05% max.
d)	Nickel	-	0.25% min.
e)	Copper	-	0.20% min.
f)	Combined (Ni,Cu,Cr)	-	1.25% min.

F. Resilient Sealed Gate Valve: Valve shall meet all provisions of ANSI/AWWA C509-87 specification as latest revised; shall have a smooth unobstructed water way which shall be a minimum of the nominal diameter of the valve. Valve ends to be specified and shall be furnished with Cor-Ten (or equal) bolts and nuts. Valves shall be manufactured by Mueller, Clow or Eddy and shall open right.

G. Valve Boxes: The valve box bottom section shall be slide-type with bell-type base. The valve box top section shall be slide-type. It shall have a top flange, but shall not have a "bead" or bottom flange. The valve box cover shall be a 2" drop-type cover to fit the 7-1/4" opening of the top section. The valve box extension shall be slide-type with a minimum 3" belled bottom. Material shall be cast iron or ductile free from defects. Interior and exterior of all components shall be bituminous coated with a minimum of 4 mils dry film thickness.

H. Service Box and Rod:

1. Service Box Specification:

   Shall be 1.0" (in.) I.D. black iron or steel pipe with top having N.P.I. threads for 1.0" screw-on cover.

   Shall be Erie style with 5-6' (ft.) slide-type riser.

2. Service Box Cover Specifications:

   Shall be Quincy type (heavy duty) cover that screws on (1.1 above).

   Shall be tapped with a 1" rope thread with a solid brass plug with pentagon operating head.

3. Service Box Foot Piece Specifications

   The standard foot piece shall be heavy duty (Ford style or equal) cast iron design.

   The large, heavy-duty foot piece shall have an arch that will fit over 2" ball-valve curb-stops.

4. Service Rod Specifications

Shall be 24"-30" in length and have a self-aligning design.

Shall be of circular dimension and constructed of:

a) 5/8" dia. min. cold rolled steel with an epoxy coating (minimum 4 mil D.F.T.), or,

b) 1/2" dia. min. #304 stainless steel.

Shall have a yoke design that is an integral part of the rod.

The curb-stop attachment point shall be a brass cotter pin.

The rod "wrench-flat" shall have a minimum thickness of 1/4" tapered to 1/16" and width of 5/8" or 1/2".

I. Tapping sleeves shall be as approved by the local water company. Options include the following:

1. Tapping sleeve shall be mechanical joint with recessed outlet flange for tapping valve; conform to AWWA C207, Class D, with rated maximum working pressure of 200 psi. The side rubber gaskets shall be rectangular in cross-section and fit into grooved channels in the casting. These gaskets shall extend the entire length of the sleeve and shall not require cutting or trimming to match MJ end gaskets. Tapping sleeve shall be AB-CD pattern to permit use of plain rubber and duck-tipped gaskets for various O.D. piping sizes.

2. Mechanical joint with accessories furnished; glands, gaskets, and Cor-Ten T-bolts and nuts or equal. All flange bolts shall be 316 stainless steel or silicone bronze. Interior and exterior to be bituminous coated with a minimum of 4 mils dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and brass plug.

3. The tapping sleeve shall be Romac Industries Inc., 304 Stainless Steel Tapping Sleeves with ductile iron flange. Flange bolts shall be stainless steel or silicon bronze. The sleeve shall be rated for a maximum, working pressure of 200 psi. The interior and exterior shall be bituminous coated with a minimum of 4 millimeters dry film thickness. The sleeve shall be provided with a 3/4" F.I.P.T. test port and plug.

J. Corporation Stop:

1. 3/4" - 1" shall be a ball valve design with a brass ball that is Teflon (or equal) coated. 1-1/2" - 2" shall be ball-corp design with an on-off identification mark on the operating nut.

2. The valve shall be supported by 2 seats for water tight shut-off in either direction.

3. The valve shall have a full port opening.

4. The body of the corporation-stop shall be of heavy duty design.

K. Specifications for Services:

1. Material

   Copper Tubing: ASTM B88, Type K, Seamless, Annealed, 2 Inch Diameter Maximum.

2. Fittings

   Brass Compression Manufactured by Ford, Mueller or McDonald.

L. Curb Stops

1. For sizes 3/4" - 2", the valve shall be a brass ball that is Teflon (or equal) coated.

2. The ball shall be supported by seats which are water tight in either direction.

3. The valve shall have a full-port opening.

4. The valve shall open with ¼ turn (90^{o}) with a check or stop.

5. The valve shall not have a drain.

6. The valve stem shall have 2 "O" rings and a bronze ring lock which holds the stem solidly in the valve body.

7. The valve body shall be a heavy duty design.

M. Hydrant (Not in Contract): Hydrant shall be Mueller Centurion or Eddy F-2641 all with stainless steel nuts and bolts below grade. The hydrant shall have an epoxy coated base, and open left. The nozzles shall have National Standard Threads. Operating nut shall be 1-15/16".

All material used in the production of fire hydrants for ordinary service shall conform to the specifications designated for each material listed in AWWA Standard C502.

N. Joint Restraint: Place thrust blocking consisting of 2,500 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 lbs./sq. ft. when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft.	90 Deg. Bend Sq. Ft.	45 Deg. Bend Sq. Ft.	22 Deg. Bend Sq. Ft.
4"	1.0	1.0	1.0	1.0
6"	1.5	2.0	1.0	1.0
8"	2.5	3.5	1.8	1.0
10"	4.0	5.5	2.8	1.5
12"	6.0	8.0	4.0	2.0
14"	8.0	11.0	5.5	3.0
16"	10.0	14.2	7.0	4.0

O. Rigid Insulation: Installation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

Materials submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05 meet Federal Specifications HH1524B Type II, Class B.

W. Temporary Water Service: Provide temporary water service as necessary during the site work and building construction. Use materials as approved by the Portland Water Department.

X. Meter Pit: Provide meter pit with fire line meter and valves as shown on the drawings.

PART 3 - EXECUTION

3.1 WATER DISTRIBUTION SYSTEM

A. Building Service Lines: Install water service lines to point of connection within approximately five feet outside of buildings to which such service is to be connected and make connections thereto. If building services have not been installed provide temporary caps. Connections of service lines to distribution mains shall be constructed in accordance with the following requirements.

1. 2 Inch and Larger: Connect by rigid connections and provide gate valve below frost line.

B. Regrading: Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

C. Pipe Laying, General

1. Install to same tolerances as specified for storm drain (Section 02720).

2. Do not lay pipe on unstable material, in wet trench, or, when trench or weather conditions are unsuitable.

3. Support pipe laid in fill area at each joint, by brick or concrete piers carried down to solid undisturbed earth.

4. Do not lay pipe in same trench with other pipes or utilities.

5. Hold pipe securely in place while joint is being made.

6. At least one foot shall separate water lines vertically from other pipes or underground structures.

7. Where water pipes cross sanitary sewers or are laid parallel and adjacent to them, bottom of water pipe shall be separated by not less than one foot above top of sewer and ten feet horizontally.

8. Do not work over, walk on, pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.

9. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.

10. Install water lines to avoid storm and sanitary sewer lines.

11. Clean interior or pipe thoroughly of all foreign matter before installation. Keep pipes clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.

12. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored. Pipe clamps and tie rods, or concrete thrust blocks may be used. Type of pipe and soil conditions determine methods. Anchor water mains as specified in NFPA No. 24.

13. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work thoroughly clean exposed materials and equipment.

D. Laying Ductile Iron Pipe

1. Installing Pipe: Lay pipe in accordance with AWWA C600.

2. Joints:

   a. Mechanical: AWWA C111. Provide sufficient quantities of bolts, nuts, glands and gaskets for each socket opening on pipe and fittings.

   b. Push-On: Apply thin film of lubricant to gasket and place in proper position in contour of bell. Insert beveled end of joining pipe and make contact with gasket. Force beveled end of pipe to bottom of bell without displacing gasket. Do not caulk. Only lubricant furnished by manufacturer of pipe shall be used.

c. Flanges: AWWA C115. Install only in concrete pits. Must be watertight and set not less than six inches from walls to floor.

E. Setting of Valves:

1. Install gate valves as indicated on the Drawings and support on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body.

2. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

3. Clean valves and curb stops interior before installation.

F. Setting of Fire Hydrants (Not in Contract):

1. Install fire hydrant assemblies as indicated on Drawings in vertical and plumb position with steamer nozzle pointed toward building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil or concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

2. Clean interior of hydrants of all foreign matter before installation.

3. Set center of each hydrant not less than two (2) feet nor more than six (6) feet back of edge of road or face of curb. Set barrel flange not more than two (2) inches above finished grade and eighteen (18) inches between center of steamer nozzle and finished grade.

G. Pipe Sleeves: Install where water lines pass through retaining and foundation walls. Properly secure in place, with approximately 1/4-inch space between pipe and enclosing sleeve, before concrete is poured. Caulk annular opening between pipe and sleeves, and seal with asphaltic compound consisting of bituminous materials mixed with mineral matter. Install piping so that no joint occurs within a sleeve. Split sleeves may be installed where existing lines pass through new construction.

H. Meter: The Contractor will obtain the meter from the Portland Water Department and install the domestic water meter for the installation and will pay all usage charges connected with water supply until the installation is accepted by the Owner.

3.2 DISINFECTION

A. Disinfect distribution system with chlorine before acceptance for domestic operation in accordance with the following procedures:

1. The only acceptable method of disinfection shall be the continuous Feed Method of chlorine.

2. The rates of introduction of the chlorine and water shall be so proportioned so that the chlorine concentration in the water is maintained at a minimum of 50 mg/l available chlorine.

3. During the application of the chlorine, valves shall be operated in such a manner that the treatment dosage shall not flow back into the line supplying the water. The operation of the valves shall be done under Water Department supervision.

4. The chlorinated water shall be retained in the main for at least 24 hours. At the end of the 24 hour period, the treated water shall contain no less than 25 mg/l available chlorine.

5. At the end of the retention period, the chlorinated water shall be flushed from the main until the chlorine in the water leaving the main is no higher than the normal residual in the system, or less than 1 mg/1.

6. All bacteriological tests shall be collected in sample bottles and shall be tested at a State certified laboratory. All costs for disinfection of the main as well as bacteriological costs shall be borne by the Contractor.

3.3 TESTING OF WATER DISTRIBUTION SYSTEM

A. Test water distribution system pipe sizes installed below grade and outside building in accordance with following procedures:

1. Before pressure testing the water main, air shall be completely expelled from the pipe. If permanent air valves are not located at all high points, corporation stops shall be installed at all high points so that the air can be expelled as the pipe is being filled. After completion of the test, the corporation stops shall either be removed or left in place at the discretion of the Water District.

2. If fire hydrants are installed on the new water main, the test shall be conducted against a closed hydrant valve.

3. The test pressure shall be 1.5 times the static pressure at the lowest point of elevation of the line and shall not be less than 150 p.s.i.

4. The test shall not exceed the pipe or thrust restraint design pressures, nor exceed twice the rated pressure of the valves or hydrants and shall not exceed the rated pressure of the valves, if resilient - sealed butterfly valves are used.

5. Water, only, shall be used to bring the main to the required test pressure. The type of pump shall be approved by the Portland Water Department.

6. The test shall be of at least two hours in duration. A leakage test shall be conducted immediately after the pressure test.

7. After the pressure test period, water shall be pumped into the main to bring the pressure back up to the initial test pressure. No pipe installation shall be accepted if the leakage is greater than that listed in Table 1 attached to this Section.

If any pipe installation shows a leakage greater than that specified in Table 1, the contractor at his own expense shall locate and repair the leak until it is within the specified allowance.

The pressure and leakage tests shall be conducted under Portland Water Department's supervision.

END OF SECTION 33 11 00

Table 1

Allowable Leakage for Mechanical-Joint or Push-On Joint Pipe in 18-ft. Nominal Lengths*

Avg. Test Pressure (psi)	Pipe Size - inches															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
	Allowable Leakage per 1,000 ft-gph															
250	0.48	0.71	0.95	1.42	1.90	2.38	2.85	3.33	3.80	4.28	4.75	5.70	7.13	8.55	9.98	11.40
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50	5.40	6.76	8.11	9.46	10.81
200	0.42	0.64	0.85	1.27	1.70	2.12	2.55	2.97	3.40	3.82	4.25	5.10	6.37	7.61	8.92	10.19
175	0.40	0.60	0.79	1.19	1.59	1.99	2.38	2.78	3.18	3.58	3.97	4.77	5.96	7.15	8.34	9.54
150	0.37	0.55	0.74	1.10	1.47	1.84	2.20	2.58	2.94	3.31	3.68	4.41	5.52	6.62	7.72	8.83
140	0.36	0.53	0.71	1.07	1.42	1.78	2.13	2.49	2.84	3.20	3.55	4.26	5.33	6.40	7.46	8.53
130	0.35	0.51	0.69	1.03	1.37	1.71	2.06	2.40	2.74	3.08	3.42	4.11	5.14	6.16	7.19	8.22
120	0.33	0.49	0.66	0.99	1.32	1.64	1.98	2.30	2.63	2.96	3.29	3.95	4.93	5.92	6.91	7.89
110	0.31	0.47	0.63	0.94	1.26	1.58	1.89	2.21	2.52	2.83	3.15	3.78	4.72	5.67	6.61	7.56
100	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.40	6.31	7.21
90	0.28	0.43	0.57	0.86	1.14	1.42	1.71	1.99	2.28	2.56	2.85	3.42	4.27	5.13	5.98	6.84
80	0.27	0.40	0.54	0.80	1.08	1.34	1.61	1.88	2.15	2.42	2.69	3.22	4.03	4.84	5.64	6.45
70	0.25	0.38	0.50	0.75	1.00	1.26	1.51	1.76	2.01	2.26	2.51	3.01	3.77	4.52	5.28	6.03
60	0.23	0.35	0.46	0.70	0.93	1.16	1.39	1.63	1.86	2.09	2.32	2.79	3.49	4.19	4.89	5.58
50	0.21	0.32	0.42	0.64	0.85	1.06	1.28	1.49	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.10
40	0.19	0.28	0.38	0.57	0.76	0.95	1.14	1.33	1.52	1.71	1.90	2.28	2.85	3.42	3.99	4.56

* The allowable leakage for a pipeline is calculated by multiplying the leakage per hour per 1,000 feet at the average test pressure and for the diameter of pipe tested as obtained from the above table by the duration of the test in hours and the total length of the line being tested divided by 1,000. If the line under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

SECTION 33 31 00

SANITARY SEWER COLLECTION/CONVEYANCE SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, services, equipment, and other necessary items required for accompanying the construction of the sanitary systems. This shall include, but not be limited to, the following:

Sanitary sewer drainage piping, Fitting and Accessories, Cleanouts, and Bedding.

Set lines, elevations, and grades for sanitary sewer system work and control system for duration of work, including careful maintenance of benchmarks, property corners, monuments, or other reference points.

Provide sanitary sewer systems for wastewater only. Do not connect foundation drains, roof leaders, or other "illicit sources".

B. Related Sections:

1. Section 33 05 00 – Common Work Results for Utilities

2. Construction Drawings.

3. Local governing authority and code requirements.

4. All necessary construction permits.

5. All materials, installation, and workmanship will comply with the requirements specified in this section, the requirements of the Maine State Plumbing Code and the City of Portland Building Requirements. Where a more stringent standard exists, the more stringent standard shall apply.

1.2 SUBMITTALS

A. Product Data: Provide catalog materials indicating pipe, pipe accessories, and fittings.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed ASTM designations.

1.3 QUALITY ASSURANCE

A. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.

B. ANSI/ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

C. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.

E. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

F. ASTM A746 - Ductile Iron Gravity Sewer Pipe.

G. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

H. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

I. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

J. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.4 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 COORDINATION

A. Coordinate the work with termination of the sanitary sewer connection outside building, connection to municipal sewer utility service, and trenching.

PART 2 - PRODUCTS

2.1 NON-METALLIC CASING SPACER & END SEAL FOR WATER CARRIER PIPE – VACANT

2.2 GRAVITY SEWER PIPE

A. Pipe shall be furnished and installed at locations shown on the plans, and to the line and grade indicated on the plans. All piping shall be complete, including fittings, connections to existing structures, and other miscellaneous items of work

B. Pipe shall be SDR-35 PVC pipe, of the sizes shown on the plans shall be manufactured by Johns-Manville or CertainTeed Products Corp. or approved equal.

C. Pipe shall conform to ASTM D-3034 for sizes 4" – 15" and ASTM F-679 for sizes 18" – 27" with dimension ratio of SDR-35. PVC resin compound shall conform to ASTM D-1784.

D. Standard pipe laying lengths shall be 13 ft.

E. No saddles are permitted on this project. The Contractor will take care in locating new sewer service saddles.

F. The pipe shall be colored green to identify it for sewer applications.

G. Fittings will be PVC Gravity Sewer Fittings and meet the requirements and intent of the National Standards ASTM D-3034 for materials and ASTM D-3212 for joints. Contractor shall furnish and install all fittings as required in the pipelines. These will be used for service connections.

H. All joints PVC pipe shall be gasketed in accordance with ASTM D-3212 and ASTM F-477 and other industry standards and will be "push-on". Joints will be made using gasketed couplings and bells provided by the pipe manufacturer, and installed in accordance with the pipe manufacturer's published recommendations.

I. No glued joints will be allowed in any form. Any joint, which is not properly made, shows signs of leakage, or is any way defective, shall be remade to the satisfaction of the District.

J. Pipe will be furnished with Gaskets pre installed and lubricants as standard accessories.

2.3 SEWER SERVICE PIPE

A. Sewer service pipe shall be furnished and installed as required. Connections shall be complete including excavation and backfill, pipe, fittings, connections and other miscellaneous items of work. The service pipe will be tested as per the sewer main testing section prior to connection of any building sewer service to the pipe.

B. Pipe shall be 6-inches in diameter SDR-35 PVC pipe, as manufactured by Johns-Manville or CertainTeed Products Corp. or approved equal.

C. Pipe shall conform to ASTM D-3034 with dimension ratio of SDR-35 PVC resin compound shall conform to ASTM D-1784.

D. Standard pipe laying length shall be 13 ft.

E. The pipe shall be colored green to identify it for sewer applications.

F. Fittings will be PVC Gravity Sewer fittings and meet the requirements and intent of the National Standards ASTM D-3034 for materials and ASTM D-3212 for joints. All elbows used for service connections shall be bends or sweeps.

G. All joints PVC pipe shall be gasketed in accordance with ASTM D-3212 and ASTM F-477 and other industry standards and will be "push-on". Joints will be made using gasketed couplings and bells provided by the pipe manufacturer, and installed in accordance with the pipe manufacturer's published recommendations.

H. No glued joints will be allowed in any form. Any joint, which is not properly made, shows signs of leakage, or is any way defective, shall be remade to the satisfaction of the District.

I. Pipe will be furnished with Gaskets pre installed and lubricants as standard accessories.

J. Connections to existing service pipe not compatible with a gasketed joint will be made with a flexible coupling with stainless steel band, housing and screw.

2.4 FLEXIBLE COUPLINGS

A. This work shall consist of furnishing of and installing all flexible couplings specified herein.

B. Flexible couplings shall be Elastomeric Polyvinyl Chloride Couplings, as manufactured by Fernco Inc., of Davidson, MI or approved equal.

C. Flexible couplings must comply with applicable parts of ASTM #C443, C425, C564, and D1869.

D. Flexible couplings shall have series 300 stainless steel clamps both ends. All parts of the clamp are to be Series 300 stainless steel including the band, housing and screw.

E. Flexible couplings shall be of correct size and configuration for the application. The couplings will be specifically manufactured for the sizes and types of piping to be connected and clearly labeled on the coupling.

F. The manufacturer shall provide standard installation instructions with the flexible couplings.

2.5 CLEANOUTS

A. Lid and Frame: Heavy duty cast iron construction, manufactured by Mueller: Lid Design: (Refer to Section 33 39 00).

B. Shaft Construction: Cast iron shaft of internal diameter as specified on plans with 2,500 psi concrete collar for cleanouts located in paved areas.

C. Base Pad: Cast-in-place concrete, 2,500 psi leveled top surface to receive cast iron shaft sections, sleeved to receive sanitary sewer pipe sections.

2.6 PIPE AND VALVING ASSOCIATED WITH STRUCTURES

A. All pipe and valving shall be cast/ductile iron with 125 lb ANSI standard flanges.

B. All pipe to be cement lined.

C. Air and vacuum valve (if required) shall be Crispir Model A141.

D. Paint any piping inside special appurtenances with epoxy paint in accordance with 10 state standards and/or TR-16 manual "Guides for the Design of Wastewater Treatment Works."

PART 3 - EXECUTION

3.1 INSTALLATION – NON-METALLIC CASING SPACER & END SEAL FOR WATER CARRIER PIPE – VACANT

3.2 INSTALLATION - GRAVITY SEWER PIPE

A. Each pipe and fitting shall be inspected prior to installation to insure: the gasket is properly adhered to the bell of the pipe, the pipe is straight within 1/16" end to end, the pipe is of proper shape within 5% of round, cracks or any other damage. If a pipe is found to not pass the inspection the pipe will immediately be removed from the site.

B. Pipe shall be assembled in strict accordance with the manufacturer's instructions as described below:

1. Thoroughly clean the groove and bell socket and the gasket, make sure that gasket is correctly seated.

2. After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturer's recommendations. The lubricant is supplied in sterile cans and every effort shall be made to keep it sterile.

3. Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file, grinder or pipe saw to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing.

4. Most sizes of pipe can be pushed into the bell socket with a long bar. Large pipe may require additional power, such as a pipe jack, or lever puller. The pipe supplier may provide a pipe jack or lever puller on a rental basis. A Timber header should be used between the pipe and jack to avoid damage to the pipe.

C. Excavations shall be made to a point at least 6-inches below the pipe to accommodate the ¾" crushed stone bedding material. This material is to extend from 6" below the pipe to 6" above the pipe.

D. All excavations are to be kept dry while pipe is being installed and until each joint and pipe has been observed by the Engineer, and approval given to commence backfilling operations.

E. Pipe shall be laid in strict accordance with the pipe manufacturer's published recommendations. Any pipe, which is not installed to grade and alignment, shall be reinstalled to the satisfaction of the Engineer.

F. Foreign material shall be prevented form entering the pipe during installation. No debris tools clothing or other material will be placed in the pipe at any time.

G. Temporary pipe plugs shall be used at all times when work is in progress, the open end of the pipe shall be closed at all times by means of a water tight plug or other means acceptable to the Engineer. When practical the plug shall remain in the place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

H. The centerline of the pipe will not deviate more than 1/16" from the line between the two manholes it is being installed on.

I. The pipe shall not deviate more than .02' vertically from the designed grade in the total pipe run from manhole to manhole.

J. If the contractor over excavates the pipe will be brought to grade with crushed stone no other material will be allowed under the pipe.

K. No pipe installation will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the Engineer.

L. Testing will be done in accordance with the Contract Documents.

M. Chimneys shall be located where directed by the District, and constructed in accordance with the details shown on the plans. Concrete encasement shall be 3,000-pound class. Ends of the chimney shall be capped with standard caps.

3.3 INSTALLATION – SEWER SERVICE PIPE

A. Each pipe and fitting shall be inspected prior to installation to insure: the gasket is properly adhered to the bell of the pipe, the pipe is straight within 1/16" end to end, the pipe is of proper shape within 5% of round, cracks or any other damage. If a pipe is found to not pass the inspection the pipe will immediately be removed from the site.

B. Pipe shall be assembled in strict accordance with the manufacturers instructions as described below:

1. Thoroughly clean the groove and bell socket and the gasket, make sure that gasket is correctly seated.

2. After cleaning dirt or foreign material from the plain end, apply lubricant in accordance with the pipe manufacturer's recommendations. The lubricant is supplied in sterile cans and every effort shall be made to keep it sterile.

3. Be sure that the plain end is beveled; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file, grinder or pipe saw to remove all sharp edges. Push the plain end into the bell of the pipe. Keep the joint straight while pushing.

4. Most sizes of pipe can be pushed into the bell socket with a long bar. Large pipe may require additional power, such as a pipe jack, or lever puller. The pipe supplier may

provide a pipe jack or lever puller on a rental basis. A Timber header should be used between the pipe and jack to avoid damage to the pipe.

C. Excavations shall be made to a point at least 6-inches below the pipe to accommodate the ¾" crushed stone bedding material. This material is to extend from 6" below the pipe to 6" above the pipe.

D. All excavations are to be kept dry while pipe is being installed and until each joint and pipe has been observed by the Engineer, and approval given to commence backfilling operations.

E. Pipe shall be laid in strict accordance with the pipe manufacturer's published recommendations. Any pipe, which is not installed to grade and alignment, shall be reinstalled to the satisfaction of the Engineer.

F. Foreign material shall be prevented form entering the pipe during installation. No debris tools clothing or other material will be placed in the pipe at any time.

G. Temporary pipe plugs shall be used at all times when work is in progress, the open end of the pipe shall be closed at all times by means of a water tight plug or other means acceptable to the Engineer. When practical the plug shall remain in the place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.

H. The pipe shall not deviate more than .02' vertically from the designed grade in the total pipe run from manhole to manhole.

I. If the contractor over excavates the pipe will be brought to grade with crushed stone no other material will be allowed under the pipe.

J. No pipe installation will be allowed to begin at any point other than a service tee or other appurtenance without the expressed consent of the Engineer.

3.4 INSTALLATION – FLEXIBLE COUPLINGS

A. The contractor shall install the flexible couplings at the locations indicated on the design plans.

B. The contractor shall install the flexible couplings to insure a watertight seal at the locations shown on the design plans. The screw torque be as required by the manufacturer.

C. The contractor shall remove from site any couplings that are damaged prior to or during installation of the flexible couplings.

PART 4 – FIELD QUALITY CONTROL

4.1 TESTING OF SANITARY SEWER SYSTEM (GRAVITY MAIN)

A. All sewers throughout the entire length of lines shall be tested for water tightness. Testing shall be by internal pressure tests. All pipes shall pass the following tests prior to final acceptance.

B. Where groundwater is high the District may elect to accept infiltration measurements in lieu of exfiltration tests.

C. The Contractor shall furnish, at his own expense, the necessary facilities for making the test including the furnishing and placing of bulkhead, furnishing and placing of water and other necessary materials, labor and equipment.

D. A section under these specifications shall mean a length of sewer between any two manholes. The force mains shall be tested after the lines are completed.

E. Internal Pressure Test for Force Mains: VACANT

F. Low Pressure Air Test For Gravity Sewers:

a. The contractor shall test the gravity sewers with a low-pressure air test. It shall be conducted in compliance with the following:

After completing back fill of a section of wastewater line, the Contractor shall, at his own expense, conduct a Line Acceptance Test using low-pressure air. The test shall be performed using the below stated equipment, according to stated procedures and under the supervision of the District.

G. Gravity Sewer Test Equipment:

a. Cherne Air-Loc Equipment, as manufactured by Cherne Industrial, Inc. of Edina, Minnesota or approved equal. Equipment used shall meet the following minimum requirements:

i. Pneumatic plugs shall have a sealing length equal to or greater that the diameter of the pipe to be inspected.

ii. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.

iii. All air used shall pass through a single control panel.

iv. Three individual hoses shall be used for the following connections:

- From control panel to pneumatic plugs for infiltration.
- From control panel to sealed line fro introducing the low-pressure air.
- From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

4.2 GENERAL LEAKAGE TESTING INSTRUCTIONS

A. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be checked. Air shall be introduced into the plugs to 25 psig. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.

B. After a manhole-to-manhole reach of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole and inflated to 25 psig. Low-pressure air shall be introduced into this sealed line until the internal air pressure reaches 4 psig greater than the average backpressure of any ground water that may be over the pipe. At least two minutes shall be allowed of the air pressure to stabilize.

C. After the stabilization period (4.0 psig minimum pressure in the pipe), the air hose from the control panel to the air supply shall be disconnected. The portion of line being tested shall be termed "Acceptable" if the time required in minutes for the pressure to decrease from 4.0 to 3.0 psig (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:

Pipe Dia. In Inches	Minutes
4	2.0
6	3.0
8	4.0
10	6.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

D. In areas where ground water is known to exist, the Contractor shall install a one-half inch diameter capped pipe nipple approximately 10" long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the Line Acceptance Test, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings. (For example, if the height of water is 11 ½ feet, then the added pressure will be 5 psig. This increases the 4.0 psig to 9.0 psig and the 3.0 psig to 8.0 psig. The allowable drop of one pound and the timing remain the same).

E. The Contractor shall furnish all labor, materials and equipment for making infiltration and leakage tests.

F. If the pipe fails to meet any of the test requirements the contractor will at his own expense make the necessary repairs. These repairs must be acceptable to the Engineer.

4.3 PIPE DEFLECTION TEST

A. Pipe shall be tested for deflection maximum allowable deflection shall be 5.0 percent. This is computed by multiplying the amount of deflection by 100 and dividing by the nominal diameter of the pipe.

B. The contractor shall wait a minimum of 30 days from the date installation of the section of the sewer. Including placement and backfilling over the installed pipe. Prior to performing the deflection test on the pipe.

C. This test will be performed by pulling a specially designed gauge tool through the pipe. The tool shall be in accordance with the recommendations of the pipe manufacturer and acceptable to the engineer.

D. If a section of pipe is found to be out of compliance it will be repaired at the contractor's expense.

THE ATTENTION OF THE CONTRACTOR IS DIRECTED TO THE STRICT REQUIREMENTS RELATIVE TO MAXIMUM RATES OF THE INFILTRATION AND TO THE IMPORTANCE OF THESE SPECIFICATIONS RELATIVE TO TIGHT JOINTS REQUIRED. SEWERS NOT MEETING THE ABOVE REQUIREMENTS SHALL BE REPAIRED AS NECESSARY AT THE CONTRACTOR'S EXPENSE.

4.4 WARRANTY

A. All products shall be warranted against failure caused by manufacturing defects for a period of one year. Any product found to be so defective and returned within one year from date of shipment will be replaced without charge. The above warranty is made in lieu of, and we disclaim, any and all other warranties, expressed or implied, including the warranties of merchantability and fitness for a particular purpose, and buyer agrees to accept the products without any such warranties. We hereby disclaim any obligation or liability for consequential damages, labor costs or any other claims or liabilities of any kind whatsoever.

END OF SECTION 33 31 00

SECTION 33 39 00

APPURTENANCES FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage and accessories.
2. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.
3. Masonry manholes sections with masonry transition to lid frame, covers, anchorage and accessories.
4. Catch basin structures.
5. Electrical handholes if required on the Contract Drawings.

B. Related Sections:

1. Section 31 20 00 – Earthmoving
2. Section 33 41 00 – Storm Utility Drainage Piping
3. Section 33 31 00 – Sanitary Sewer Systems
4. Local Governing Authority and Code Requirements
5. Construction Drawings

1.2 REFERENCES

A. ANSI/ASTM C55 - Concrete Building Brick.

B. ASTM A48 - Gray Iron Castings

C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

E. ASTM D1248 - Precast Polyethylene Manholes.

F. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

1.3 SUBMITTALS

A. Shop Drawings: For all precast structures indicate manhole locations, rim elevation, piping, sizes, and elevations of proposed penetrations. For all other precast appurtenances, provide dimensional data, ASTM compliance certificates, and load capacity where applicable.

B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions. Each precast structure shall have a diagram showing the dimensions and location of all openings or penetrations.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE ITEMS

A. Precast Manhole and Sections: Manhole and super-structures shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Sections shall be installed with a flexible plastic gasket equal to or better than "Ram-Nek" as manufactured by K. T. Snyder Co., Houston, Texas, or sections may be fabricated to accept Tylox "0" rubber gaskets as manufactured by Hamilton Kent Manufacturing Co., Kent, Ohio. The casting and the outside of the brick work required to bring the rim to grade shall be plastered with at least 3/8" mortar, thoroughly troweled to leave a smooth waterproof vertical exterior surface.

Manhole steps shall be forged aluminum safety type, alloy 6061, temper T6, or reinforced polypropylene plastic. Steps shall be cast or anchored into walls of precast sections to form a ladder with a distance of 12 inches between steps.

The Contractor shall furnish the name of the manufacturer to the Engineer prior to commencing work.

B. Precast Manhole Bases: Manhole bases shall be precast reinforced concrete of the dimensions indicated on the Plans conforming to ASTM Specification C478. Bases shall be placed on a well compacted layer of crushed stone.

Jointing system for pipe entering or leaving manholes shall be a flexible manhole sleeve cast in the base. A stainless steel pipe clamp shall be used to fix the pipe into the sleeve. All materials shall meet or exceed rubber quality standards of ASTM C-443 and C-361.

For manhole bases, a minimum of 4 inches shall be allowed between pipe invert and inside bottom of base for construction of brick inverts.

Where precast bases are used for drop manholes, a 6 inch concrete slab is to be placed under the base section large enough to receive the concrete encased drop pipes. Provide suitable ties between manhole sections and drop pipe encasements.

Prior to ordering precast manhole bases, all angles between incoming pipes are to be field checked to incorporate possible line changes required in the field layout.

C. Outlet Control Structure: VACANT

D. Precast Tanks, Vaults, and Appurtenances: VACANT

2.2 CASTINGS

A. The Contractor shall furnish all cast iron frames, grates, and covers conforming to the details shown on the Drawings, or as hereinbefore specified.

B. Castings shall be at least Class 25 conforming to the ASTM Standard Specifications for Gray Iron Castings, Designation A-48-64.

C. Sanitary sewer covers shall have the name "Sewer" cast therein. Storm drain covers shall have the name "Storm" cast therein. Other castings shall have an appropriate name (i.e. Electric, telephone etc.)

D. The manhole castings shall be the equal of the Portland standard non-perforated manhole frame and cover M 24 x 8-S weighing approximately 425 pounds as manufactured by the Etheridge Foundry Company, or Catalog No. LK610 as manufactured by the E.L. LeBaron Foundry Company.

E. Catch basins castings shall have frames conforming to S 24" x 8 square by Etheridge with a 24" square type "M" bicycle safe grate or catalog LK 124 (LeBaron), unless otherwise noted on the drawings.

2.3 MORTAR

A. Mortar used to adjust rims and covers for manholes shall consist of the following materials and proportions by volume: 1 part of Portland cement; 1/4 part lime hydrate; and 3 parts sand.

B. For precast reinforced concrete manholes, mortar for invert construction shall consist of the following materials and proportions by volume: 1 part Portland cement and 2 parts sand. Quantity of water in mixture shall be sufficient to produce a stiff, workable mortar, but in no case shall exceed 5-1/2 gallons of water per sack of cement.

2.4 BRICK

A. Brick for manholes and catch basins shall meet Standard Specifications for Sewer Brick, AASHTO Designation M-91-42, Grade SA, Size No. 1 wire cut. Any brick rejected by the Engineer as unsuitable shall be immediately removed from the work.

2.5 VENTS

A. Vents, when required by the Contract Drawings, shall be constructed of galvanized piping of the diameter indicated on the plans with a minimum size of 4" with threaded joints. The top of the vent shall have a minimum of 12 square inches of screened opening to permit air passage, and a cap to prevent extraneous material from entering the vent. The cap shall not interfere with the air passage. Vents shall be connected to appurtenances using a cast in wall pipe.

2.6 SITE CONCRETE

A. Site concrete shall meet the requirements set forth below:

1. Aggregate: The aggregate shall conform to the Standard Specifications for Concrete Aggregates, ASTM Designation C-33, as revised.

   (a) Sand shall be a medium sand with a fineness modules of 2.60 - 2.90.
   (b) Coarse aggregate shall not exceed 1-1/2 inches for mass concrete.

2. Cement: All cement shall be a Portland Cement conforming to the requirements of Standard Specifications of the American Society for Testing Materials, Designation C-150, as revised, Type II. An air entraining agent, approved by the Engineer, shall be used.

3. Proportioning Concrete:

Maximum Size Coarse Aggregate (Inches)	Air Content Percent by Volume
1-1/2, 2, or 2-1/2	5 +/- 1
3/4 or 1	6 +/- 1

The strength of the concrete shall be fixed in terms of water-cement ratio in accordance with trial batches of the materials to be used. All concrete placed under this Specification shall be mixed in the ratio not to exceed six (6) U.S. gallons of water per sack of cement, including surface water carried by the aggregate in each case. The Contractor shall determine the approximate amount of surface water contained in the aggregate, and make proper allowance. Concrete shall have a minimum 28 day strength of 3750 psi.

The Contractor shall submit the proposed mix proportions to the Engineer for approval ten (10) days prior to placing concrete. Copies of recent test results for the proposed mix design shall also be submitted.

2.7 REINFORCEMENT

A. The Contractor shall submit detailed shop drawings for concrete reinforcement in accordance with ACI 318 and ACI 315. The steel shall be deformed Grade 60 bars which conform to ASTM 615, ASTM 616, or ASTM 617. Supports, spaces, and chairs shall permit the steel to be supported in accordance with ACI 318.

2.8 INSULATION

A. Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

B. Material submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05% by ASTM C272-53 and meet Federal Specification HH1524B Type II, Class B.

C. The Contractor shall coat the insulation material in accordance with the manufacturer's instructions.

2.9 TREATMENT OF INTERIOR SURFACES

A. All interior surface of cast in place concrete structures shall have a liquid hardener applied. The application shall consist of two coats of VANDEX or approved equal installed in accordance with manufacturer's instructions including requirements for surface preparation. Catalog cuts of the hardener shall be submitted to the Engineer for approval. All interiors of concrete items shall be treated with a waterproof coating (18 mil. Film thickness).

2.10 TREATMENT OF EXPOSED SURFACES

A. All exposed exterior concrete surfaces shall have a "rub finish". Structures and appurtenances shall have an applied coating of Tnemec Series 104 H5 Epoxy applied in 2 coats or approved equal to achieve a minimum dry film thickness of 18 mils. All light pole bases shall have an epoxy finish colored to match the pole color. One coat shall be applied in the factory, a second coat shall be applied in the field.

2.11 TREATMENT OF ALL OTHER EXTERIOR SURFACES

A. All buried surfaces shall be double coated with a concrete hardener to achieve a minimum dry film thickness of 18 mils.

2.13 RAIN GUARD MANHOLE INSET

A. A self sealing removable insert shall be provided and installed in the frame of each manhole casting on sewer lines. The purpose of this device is to collect and store illicit water that may enter the manhole casting. The units shall be "RAINGUARD™" or approved equal.

PART 3 - EXECUTION

3.1 MANHOLES

A. General: All appurtenant structures shall be set level on compacted material as specified in Section 2 of these Specifications and as shown on the Plans.

B. Manhole Channels: Channels shall be constructed in all sanitary sewer manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the

Engineer or a preformed manhole channel: "FIBERLINER" or equal. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings.

2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

E. Infiltration Seal: Install rain guard or approved equal manhole inserts.

3.2 ALTERATIONS TO EXISTING MANHOLES

A. Existing manholes to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.

B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.3 ADJUSTING EXISTING MANHOLES

A. Existing manholes to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.

D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

3.4 ABANDONING MANHOLES

A. Existing manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

3.5 MANHOLE ADAPTERS

A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

3.6 PRECAST TANKS, VAULTS, AND APPURTENANCES – VACANT

PART 4 - TESTING

4.1 GENERAL

All sanitary manholes, wetwells, septic tanks, holding tanks, and other appurtenant structures shall be tested as to water tightness. If the initial test fails a retest shall be required. The Contractor has the option of either of the following methods:

A. Water Test: The inlet and outlet of the structure shall be plugged by watertight plugs furnished by the Contractor, and the manhole shall be filled with water. The water shall remain for sufficient time for the absorption into the concrete pipe to have been substantially completed. The amount of water loss from the manhole shall then be determined. The rate shall not exceed five (5) gallons per hour. Obvious leaks shall be repaired by the Contractor by excavating outside the structure, if required, at no cost to the Owner.

B. Vacuum: The manholes shall be vacuum tested by a method and apparatus subject to the prior approval of the Engineer. Vacuum testing shall be performed in the following manner:

The manhole shall be fully assembled, including all pipe connections into the structure. The manhole shall be in its final location and shall not have been backfilled prior to the performance of the test.

All lift holes shall be plugged with a non-shrinking mortar, as approved by the Engineer.

The seal between the manhole sections shall be in accordance with ASTM C923.

The Contractor shall plug the pipe openings, taking care to securely brace the plugs and the pipe.

With the vacuum tester set in place:

- Inflate the compression band to effect a seal between the vacuum base and the structure.

- Connect the vacuum pump to the outlet port with the valve open.

- Draw a vacuum to 10" of Hg. and close the valve.

- The test shall pass if the vacuum remains at 10" Hg. or drops to 9" Hg. in a time greater than one minute. If the manhole fails the initial test, the Contractor shall locate the leak and make proper repairs. Leaks may be filled with a wet slurry of accepted quick setting material.

Any appurtenant structure which shows obvious infiltration, whether tested or not, shall be sealed to eliminate said infiltration.

END OF SECTION 33 39 00

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:

1. Drainage Pipe
2. Catch basins.

1.2 RELATED DOCUMENTS – Vacant

1.3 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: Watertight in all areas.

1.4 SUBMITTALS

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

B. Shop Drawings: For manholes and catch basins. Include plans, elevations, sections, details, and manhole frames and covers and catch basin frames and grates.

C. Coordination Drawings: Show pipe sizes, locations, and elevations for all manholes and appurtenances.

D. Field quality-control test reports. Product Data: For each type of product indicated.

1.5 DEFINITIONS

Bedding: Fill placed under, beside and directly beside pipe to midpoint of pipe, prior to subsequent backfill operations.

Special Backfill: Fill placed above bedding beside and over pipe prior to other backfill operations.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipes and mains, connections, catch basins, cleanouts and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 COORDINATION

A. Coordinate the work with termination of storm connections outside building and trenching.

B. The exact location of roof drain leaders shall be determined from the Architectural Plans and including as shown on the plumbing drawings. The number and location of the roof drains may be different than shown in the site drawings. Verify roof drain lead locations with the Owner. Provide fittings to raise grade to accept roof drain 5'-0" outside of building where necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Provide any one of the following materials subject to any restrictions noted in this subsection or on plans. The contractor shall provide catalog cuts to the Owner and indicate the proposed materials to be used prior to ordering materials. The approval of the Owner must be obtained prior to ordering materials.

A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class IV unless another class type is indicated on Drawings, installed with flexible plastic (Bitumen) gaskets at all joints. Gaskets shall comply with AASHTO M-198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.

B. Polyvinyl Chloride (PVC) Pipe: Pipe and fittings shall comply with ASTM D 3034, rated SDR 35. Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, Table 2, with factory supplied elastomeric gaskets and lubricant. PVC shall not be used for any drainage pipe which will be permanently exposed to sunlight.

C. Corrugated Polyethylene Pipe (CPP), Smooth Interior: Shall conform with AASHTO Designations M294 and M252. Pipe must be installed in accordance with manufacturer's installation guidelines for culvert and other heavy duty drainage applications. Acceptable manufacturers: Advanced Drainage Systems, Inc. (ADS) N-12 and HANCOR, INC. (HiQ smooth interior). CPP pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight. Piping below the water table, subject to surcharge, or which could affect a pond level, shall be watertight. All other piping shall be silt tight.

D. Polyvinyl Chloride (PVC) Large Diameter Closed Profile Gravity Sewer Pipe, UNL-B-9: Pipe and fittings shall be installed in accordance with pipe manufacturer's installation guidelines. Ac-

ceptable manufacturer: CARLON (Vylon HC). PVC pipe shall not be used for any drainage pipe which will be permanently exposed to sunlight.

E. Manholes and Catch Basins Structures shall be provided where shown on the contract drawings.

2.2 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Manufacturers:

   a. Josam Company.
   b. MIFAB Manufacturing Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Wade Div.; Tyler Pipe.
   e. Watts Industries, Inc.
   f. Watts Industries, Inc.; Enpoco, Inc. Div.
   g. Zurn Industries, Inc.; Zurn Specification Drainage Operation.

2. Top-Loading Classification(s): Heavy duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: 48 inches (1200 mm) minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch (100-mm) minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches (900 mm).
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 8-inch (203-mm) riser with 4-inch- (100-mm-) minimum width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

    a. Material: ASTM A 48, Class 35 gray iron, unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

2.5 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (102-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
3. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include 24-inch (610-mm) by 8-inch (203-mm) rectangular riser with 4-inch (102-mm) minimum width flange bicycle proof drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

2. The location of catch basins shall be accurately located by a registered land surveyor. Catch basins shall be located as follows:

    - Edge of frame 6" off face of curb where shown near slopes granite or bit concrete curblines.
    - The center of aisle or parking modules when shown on plans.
    - In other cases, verify with Engineer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Pipe couplings and fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use non pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping, unless otherwise indicated.

a. Flexible couplings for same or minor difference OD pipes.
b. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, non pressure drainage piping according to the following:
1. Install piping pitched down in direction of flow, at the slope provided on the contract drawing.

2. The pipe shall be accurately laid to the line and grades to the satisfaction of the Engineer. The line and grade may be adjusted by the Engineer from that shown on the Drawings to meet field conditions and no extra compensation shall be claimed therefore.

The Owner or his representative reserves the right to check the elevations and alignment on any pipe for conformance with proposed line and grade. Installed grades shall be within the tolerance of plus or minus 0.02 feet from theoretical computed grades. Alignment shall be within a tolerance of plus or minus 0.04 feet. Pipe grade shall be defined as the invert elevation of the pipe. Pipe not meeting the grade tolerance or of poor alignment shall be adjusted by the Contractor.

3. No pipe laying will be allowed to begin at any point other than a manhole or other appurtenance without the expressed consent of the Engineer. The interior of each length

of pipe will be swabbed and wiped clean before laying the next length. No length of pipe shall be laid until the previous length has had sufficient fine material placed and tamped about it to secure it firmly in place to prevent any disturbance. Bell ends shall be laid uphill. Whenever the work is stopped temporarily, or for any reason whatsoever, the end of the pipe shall be carefully protected against dirt, water, or other extraneous material. Bedding shall be as shown on the Plans.

4. The pipe shall be cut as necessary for appurtenances. In general, the pipe material shall be cut by using a saw or milling process, approved by the pipe manufacturer and not by using any impact device, such as a hammer and chisel, to break the pipe. The pipe shall be cut, not broken. The cut end of the pipe shall be square to the axis of the pipe and any rough edges ground smooth.

5. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely, in a manner approved by the Engineer, to prevent entrance of trench water, dirt, or other substances.

6. All joints shall be made in a dry trench in accordance with the manufacturer's recommendations.

7. A minimum of two (2) pipe lengths or pipe stubs shall be used between any two (2) appurtenances.

8. When connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline service. Provide facilities for dewatering and for disposal of water removed from dewatering lines and excavations without damage to adjacent properties.

9. Install piping below frost line.

10. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

11. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses.

3.3 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, non pressure drainage piping according to the following:

1. 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.

2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-gasket joints.
3. Join dissimilar pipe materials with non pressure-type flexible couplings.

3.4 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch (25 mm) above surrounding grade in lawn areas.

C. Set cleanout frames and covers in pavement with tops flush with pavement surface.

3.5 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 0-1" (0-25 mm) above finished surface elsewhere, unless otherwise indicated.

3.6 CATCH BASIN INSTALLATION

A. Set frames and grates to elevations indicated.

3.7 MANHOLES

A. General: All appurtenant structures shall be set level on compacted material as specified in Section 2 of these Specifications and as shown on the Plans.

B. Manhole Channels: Channels shall be constructed in all sanitary sewer and storm drain manholes in accordance with the details shown on the Plans by a mason whose qualifications meet the approval of the Engineer or a preformed manhole channel: "FIBERLINER" or equal. The sides shall be raised by brick masonry construction from the spring line perpendicular to the height of the crown of the pipe. Where changes in directions are made at manholes, the invert shall be shaped with as great a radius as possible, and to the complete satisfaction of the Engineer. Brick shall be carefully laid to present a smooth surface as indicated on the Plans and to the satisfaction of the Engineer.

C. Pipe Connections:

1. Stubs in Manholes: Stubs placed as specified and indicated on the Drawings shall be short pieces cut from the bell ends of appropriate pipe and shall have compatible watertight stoppers. Stubs shall be set accurately to the required line and elevation and encased in the structure masonry as indicated on the Drawings:

2. Wall Sleeves and Castings: Wall sleeves and castings as specified and indicated on the Drawings shall be accurately cast to the required location and elevations as indicated on the Drawings.

D. Steps: Manhole and appurtenant steps shall be cast in the wall and installed in a straight vertical alignment.

3.8 ALTERATIONS TO EXISTING MANHOLES AND CATCH BASINS

A. Existing manholes and catch basins to be altered shall be reconstructed as indicated on the Plans or as directed by the Engineer. Adjusting to grade or connecting to an existing pipe stub is not considered an alteration.

B. Alterations covered include, but are not limited to, adjustments to manhole invert channel caused by new pipe connections or removal of existing pipe connections, and removal and plugging of existing catch basin lead and replacing with a new lead connection conforming to the appropriate section of the Specifications contained herein.

3.9 ADJUSTING EXISTING MANHOLES AND CATCH BASINS

A. Existing manholes and catch basins to be adjusted to grade shall be reconstructed to the required grade. The existing frames, grates, and covers shall be re-used unless otherwise directed.

B. The existing structure shall be dismantled to a sufficient depth to allow reconstruction conforming to the standard details.

C. Adjustment will take place just prior to placing of surface pavement for adjustments of the frame and cover. Adjustments which require dismantling and reconstruction of the super structure shall be accomplished at the time of subgrade preparation. Pavement which is removed for this adjustment shall be cut square, tack coated, and capped with 2" of bituminous concrete. No separate payment will be made for furnishing the bituminous cap.

D. Each structure that is adjusted shall be cleaned of accumulated silt, debris, or foreign matter prior to final acceptance of the work.

3.10 ABANDONING EXISTING CATCH BASINS AND MANHOLES

A. Existing catch basins and manholes designated to be abandoned shall be removed to a depth of one (1) foot below the subgrade line, unless otherwise indicated on the Plans or directed by the Engineer. The existing pipes shall be plugged with concrete and brick masonry and the catch

basins and manholes shall be filled with heavy gravel satisfactorily compacted in 9 inch lifts. Prior to backfilling, the sump shall be pumped and cleaned of all water and foreign material.

3.11 MANHOLE ADAPTERS

A. When altering an existing manhole or where a pre manufactured manhole adapter cannot be installed in precast manhole sections, the Contractor shall use a Fernco, or equal, concrete manhole adapter. The adapter shall be designed to provide a positive, watertight seal between the manhole and pipe and shall be mortared in place with Five Star grout or approved equal non-shrink grout.

3.12 PRECAST TANKS, VAULTS, AND APPURTENANCES – Vacant

3.13 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping to building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

B. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch (150-mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

2. Insulation, when required by the Drawings, shall be Styrofoam SM or TG as manufactured by the Dow Chemical Company or equal.

   Material submitted shall have a K factor of .20 @ 75 degrees by ASTM C518-70, 2-lb. density by ASTM C303-56, compressive strength of 30-lb. by ASTM D1621-64 and a water absorption of less than .05% by ASTM C272-53 and meet Federal Specification HH1524B Type II, Class B.

   The Contractor shall coat the insulation material in accordance with the manufacturer’s instructions.

3.14 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

   a. Horizontal Alignment: Less than full diameter of inside of pipe is visible between structures or ½” off design alignment.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
c. Crushed, broken, cracked, or otherwise damaged piping.
d. Infiltration: Water leakage into piping.
e. Exfiltration: Water leakage from or around piping.
f. Vertical Alignment: Within ¼" of design grade.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new watertight piping systems that have been installed below the elevation of the permanent pool in the wet pond.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 33 41 00

SECTION 33 46 00

SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes subdrainage systems for foundations and site areas. This includes perimeter foundation drains and underdrains that surround the building.

1.2 SUBMITTALS

A. Product Data: For each type of drainage panel or piping indicated on the drawings.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

2.2 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

1. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.3 SOLID-WALL PIPES AND FITTINGS

A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.

1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

B. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.

1. Gaskets: ASTM F 477, elastomeric seal.

2.4 SPECIAL PIPE COUPLINGS – Vacant

2.5 CLEANOUTS

A. Cast-Iron Cleanouts: ASME A112.36.2M; with round-flanged, cast-iron housing; and secured, scoriated, Medium-Duty Loading class, cast-iron cover. Include cast-iron ferrule and countersunk, brass cleanout plug.

2.6 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 31 Section "Earth Moving."

2.7 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Underground Subdrainage Piping:
   1. Perforated PVC sewer pipe and fittings for loose, bell-and-spigot joints.

B. Underslab Subdrainage Piping:
   1. Perforated PVC sewer pipe and fittings and loose, bell-and-spigot joints.

C. Header Piping:
   1. PE drainage tubing and fittings, couplings, and coupled joints.
   2. PVC sewer pipe and fittings, couplings, and coupled joints.

3.3 CLEANOUT APPLICATIONS

A. In Underground Subdrainage Piping:

   1. At Grade in Earth: PVC cleanouts.
   2. At Grade in Paved Areas: Cast-iron cleanouts.

3.4 FOUNDATION DRAINAGE AND UNDERDRAIN INSTALLATION

A. Install drainage system at locations shown on the Drawings. Lay pipe flat with the invert positioned at invert elevation shown on the Drawings.

B. Completely surround drainage pipe with a minimum of 6-inches of drainage course and geotextile filter fabric. Place pipe with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.

C. Underslab drainage pipe, if used, will be embedded mid-height in a minimum 12 in. layer of drainage course directly below slabs where shown on the Drawings. Completely cover exposed soil subgrade below drainage course with geotextile filter fabric prior to placement of drainage course. Place pipe with joints tightly closed in accordance with manufacturer's recommendations so that flow lines conform to required grades. For perforated collector pipe, lay pipe with perforations down.

D. Provide wall through penetrations at locations shown on the Drawings to allow connection of the perimeter and underslab drain piping, if used.

E. Any sections of piping that are not true to lines and grades, or that show any undue settlement after being laid, or are damaged will be removed and re-laid or replaced at no additional cost.

F. Test or check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

G. Provide cleanouts for drainage piping at changes of direction, bend of lines, and wherever indicated on the Drawings, and necessary to enable system to be cleaned out. Extend cleanouts to finished grade or top of slab and provide surface protection. Coordinate cleanout locations with structural and architectural improvements.

H. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

I. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

J. Install PVC piping according to ASTM D 2321.

3.5 PIPE JOINT CONSTRUCTION

A. Join PVC pipe and fittings according to ASTM D 3034 with elastomeric seal gaskets according to ASTM D 2321.

B. Join perforated PVC pipe and fittings according to ASTM D 2729, with loose bell-and-spigot joints.

C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.6 CLEANOUT INSTALLATION

A. Cleanouts for Foundation Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches (450 by 450 by 300 mm) in depth. Set top of cleanout flush with grade. Cast-iron pipe may also be used for cleanouts in non vehicular-traffic areas.
3. In non vehicular-traffic areas, use NPS 4 (DN 100) cast-iron pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

B. Cleanouts for Underslab Subdrainage:

1. Install cleanouts and riser extensions from piping to top of slab. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. Use NPS 4 (DN 100) cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout flush with top of slab.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of subdrainage system to building's solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation underslab subdrainage to stormwater sump pumps.

3.8 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.9 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00